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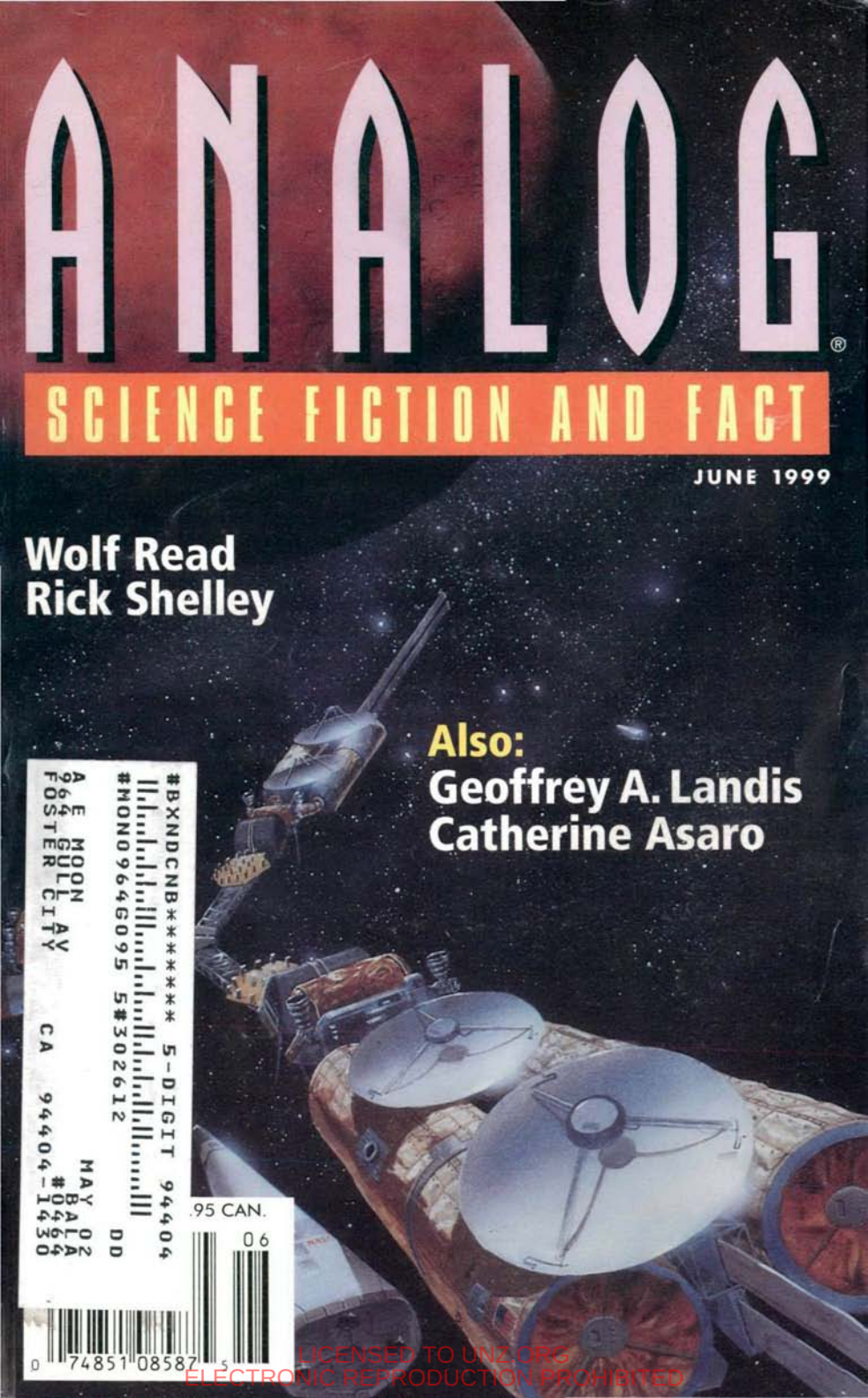

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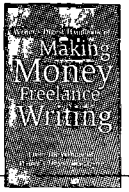

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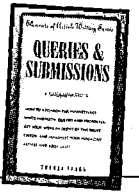

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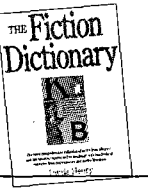

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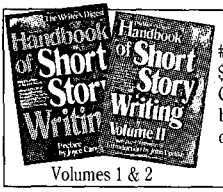

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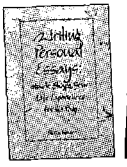

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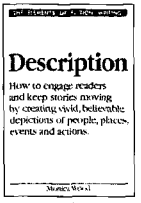
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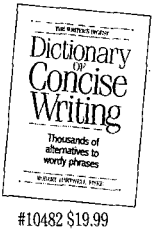

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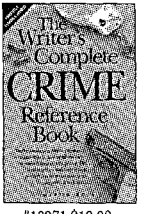

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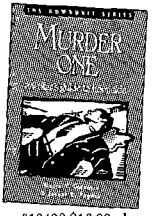

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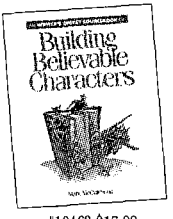

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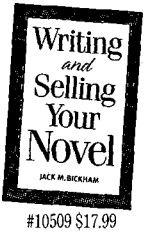

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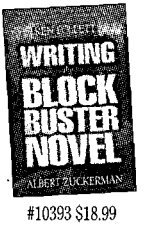

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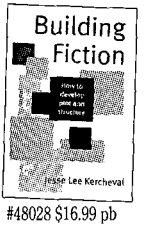

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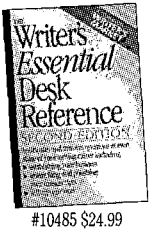

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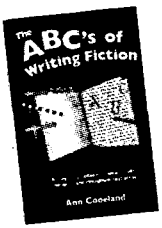

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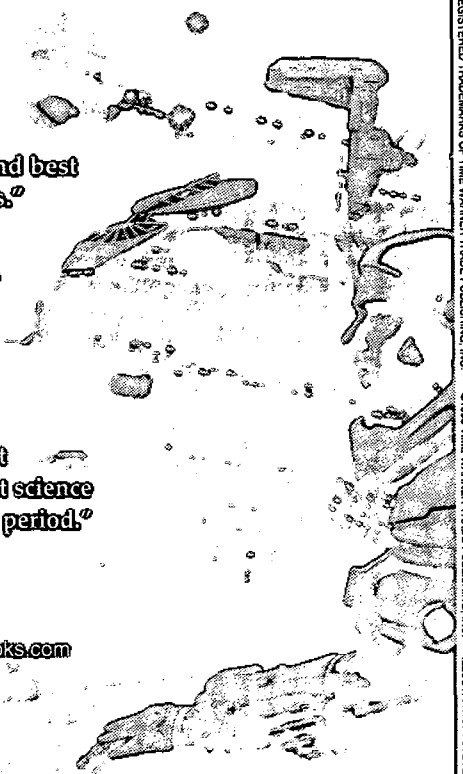

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EDITORIAL Stanley Schmidt

THE BUG AND THE BUFFALO

An old saying advises, "Don't put all your eggs in one basket."

A newer variant (which I've heard attributed to Robert A. Heinlein, though I haven't checked) is, "Put all your eggs in one basket, and then *watch that basket!*"

There's a certain amount of merit, under at least some circumstances, in each of those views. Certainly you can devote more protective diligence to a single basket than to every one of many. But if your diligence isn't enough to protect that one basket, you lose all your eggs.

So on the whole, it's probably safer in most cases to have them scattered around—as investment advisers are always telling their clients.

I recently had occasion to ponder a large-scale application of this principle while watching a documentary about the American "buffalo" (or bison, as purists insist). A recurring theme of the show was the intimate relationship between the bison and the Amerindian tribes of the Great Plains, when both were in their heyday.

Several contemporary tribe members were interviewed, explaining that the buffalo was *everything* to their culture, providing food, lodging, clothing, fuel, raw materials for utensils, and a central cultural and religious icon. "We could not survive without it," they said. So when the overwhelmingly white government of the nineteenth-century United States methodically slaughtered the buffalo to the very edge of extinction, the tribal cultures largely collapsed, too. Only recently, with buffalo being reintroduced to tribal lands, do they see any hope of a cultural renaissance.

On hearing all this, I had two thoughts. First, what the white government did was a colossally and unforgivably nasty thing. They *knew* it would devastate not only the buffalo herds but the Indian cultures that depended on them, and they did it largely for that very reason.

But the second thought I could not avoid was: it really isn't very smart for any culture (or individual) to make itself that completely dependent on any one thing.

I'm emphatically *not* saying that the Indians were stupid, or that what happened was in any sense all right. But cultures tend to take on lives of their own, doing things that are not what any of their members might choose individually. And not all cultures serve their members equally well. It's a perfectly understandable tendency to settle into a comfortable, stable routine, even if it depends on basing everything on a single concept or commodity, like buffalo. As long as the supply of that Cornerstone of Everything remains stable and dependable, it's even a good way to live, and gives outsiders an impression of admirable harmoniousness. But it has a built-in pitfall: things do *not* always stay the same, even in the absence of Evil Enemies; and if you've built your whole life around one thing, and that thing is taken away from you, *everything* collapses.

Evolutionary history is full of species and cultures that were so perfectly adapted to some particular niche that

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they could not survive a change of conditions. In the long run, the evolutionary race consistently goes not to the perfectly adapted, but to the highly adaptable. Today's perfect fit is tomorrow's misfit, because over long times, Things Change. Long-term survivors are those entities that can either survive and utilize a wide range of conditions, or can change to meet new ones.

The Plains Indians were, for quite a while, among the most fortunate of peoples. They had a simple, well-defined way of life in which all the parts fit together and functioned in a commendably smooth way—as long as there were plenty of buffalo. But removing the buffalo, no matter how it happened, was like pulling the foundation out from under a house.

In the long run, they would have been better served by a cultural system that did *not* base everything on buffalo, a system that recognized that everything changed and included built-in mechanisms for adapting to change. They can hardly be blamed for failing to do so; until just a short time before the disaster that befell them, they had little experience with fundamental change. They had something that *worked*; it worked well, and it had worked for as long as anybody could remember. Why should anyone enjoying such prosperity worry about the bottom falling out of it when such a thing had never happened before?

The trap that caught the Plains Indians is not, of course, peculiar to them. The same kind of danger is inherent in *any* situation which has been highly stable for a long time—and even in some that haven't, if there is some one element on which too much depends.

Can the current Anglo-American culture, for example, feel smugly superior to that of the Plains Indians, and immune to the same kind of trouble?

On the surface, it might seem so. Certainly this culture is far more complex and diverse than that one, and no one would ever accuse it of excessive stability. Indeed, one of the most prevalent problems people in it face today is that of coping psychologically with the rapid rate of change.

And yet, I think, we do have at least one "buffalo" of our own—something that has served us so well that we've allowed ourselves to become dependent on it to the point of vulnerability.

By now we've all heard a great deal about the "Y2K problem," often called "the Millennium Bug." The latter term has become firmly ensconced in popular parlance even though it stretches the usual definition of "bug" a bit. In programming, a bug usually means a feature of a program that, under some circumstances, can produce unanticipated and undesirable results. There's nothing unanticipated about the consequences of the Millennium Bug; anybody who gave it a moment's thought should have realized long ago that two-digit year designations (like "99" instead of "1999") in computer code would cause trouble as soon as the year became 2000, and that that *would*

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happen within the lifetimes of a great many living people and institutions.

Yet two-digit years were routinely used in a vast number of places until quite recently. Now, at virtually the last minute, just about everybody who works with computers is scrambling (or hoping *somebody* is scrambling) to undo the damage. Estimates of the degree of success that will be achieved before the deadline vary widely, but concern is widespread and serious. Systems in which needed corrections are not made will be subject to a wide range of failure modes, from programs and vehicles and power plants refusing to run, to people vanishing from payrolls or welfare rolls or having their ages (on which many legal decisions depend) misrepresented by a hundred years. In a worst case, with most of the errors uncorrected, the computer glitches resulting from this simple little economy measure could bring our elaborate civilization crashing to a halt, with grave uncertainties about how long it would take to get it moving again and how much permanent damage would be done before that happened.[1]

Most of what we hear about the Y2K problem are doomsday predictions about how terrible it will be when all this happens, or chortles from skeptics who think the threat is highly overrated, or discussions about just what's being done to head off the problem now that it's barreling down on us. Occasionally we hear someone with a bit more vision point out that the whole incident, regardless of how successfully or unsuccessfully we evade disaster on 1/1/00, provides a potent object lesson in the dangers of shortsightedness.

Sure, computer memory used to be more expensive than it is now, so there was a strong incentive to economize on it wherever possible. But that still should have been overridden by people asking: how long are we likely to need to use these records? Unless they were quite sure that there would be no possible use for them beyond 12/31/99, everything should have been formatted to allow trouble-free use beyond that date *regardless* of the cost.

The fact that so many people now need to be working so frantically to head off disaster is perhaps the most dramatic demonstration ever that trying

[1] *After all the Millenial predictions of doom people have made, we've finally come up with one that actually involves both the date change and real, significant danger!*

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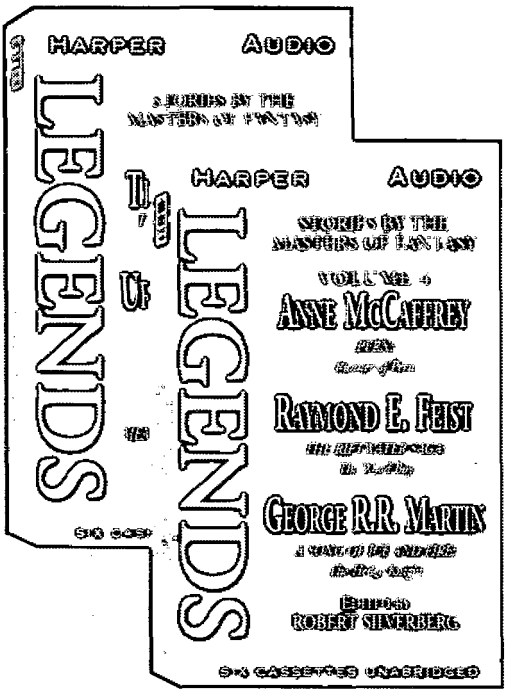

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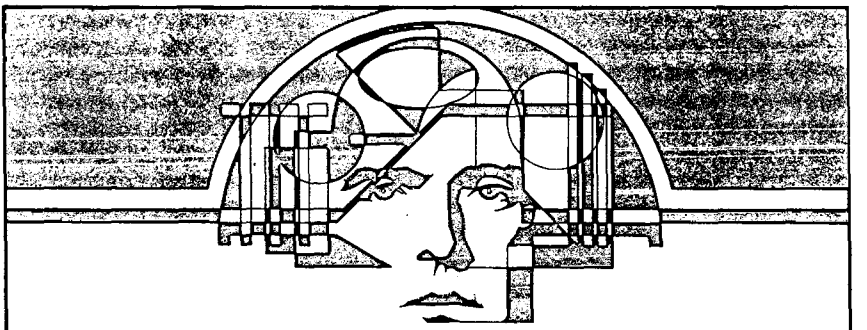
to do things as cheaply as possible can ultimately be far too expensive. When doing *anything*, we need to make as careful an estimate as we can of all possible consequences—and the time scale on which they might occur. (Yes, I took the turn of the millennium into account ten years ago, when setting up some databases that I expect to be using for the rest of my life. If I could do it, why didn't the pros?)

What's hardly ever mentioned is one more lesson provided by the Millennium Bug. Computers have become fundamental to the functioning of nearly every area of our culture, just as the buffalo was for the Plains Indians. And just as the loss of buffalo knocked the foundation out from under the Indian culture, the loss of a trustworthy computer infrastructure threatens to do the same to ours. To the extent that they erred in allowing themselves to become so dependent on one thing that supported their culture, so have we done the same thing.

The collapse may not happen, of course. With luck and diligence, we will surely be able to prevent at least some of it, and maybe most of it. But regardless of how well we come through it, the very fact that the potential for major disaster was allowed to develop, and to necessitate such a frenzy of last-minute efforts to prevent it, should serve as a loud warning of a very fundamental principle. No matter how useful something is, it is really not very bright to make your entire culture so dependent on it that you can't function without it. While we're waiting to see how this one comes out, we should be making a serious resolve to try to anticipate and avoid any similar blunders in the future—and to remember that the same principle applies to every one of us in our individual lives. □



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Wolf Read

THE TREES OF VERITÀ

There are limitations that humans may be able to accept intellectually but not emotionally—especially when a new world seems to show a way around them.

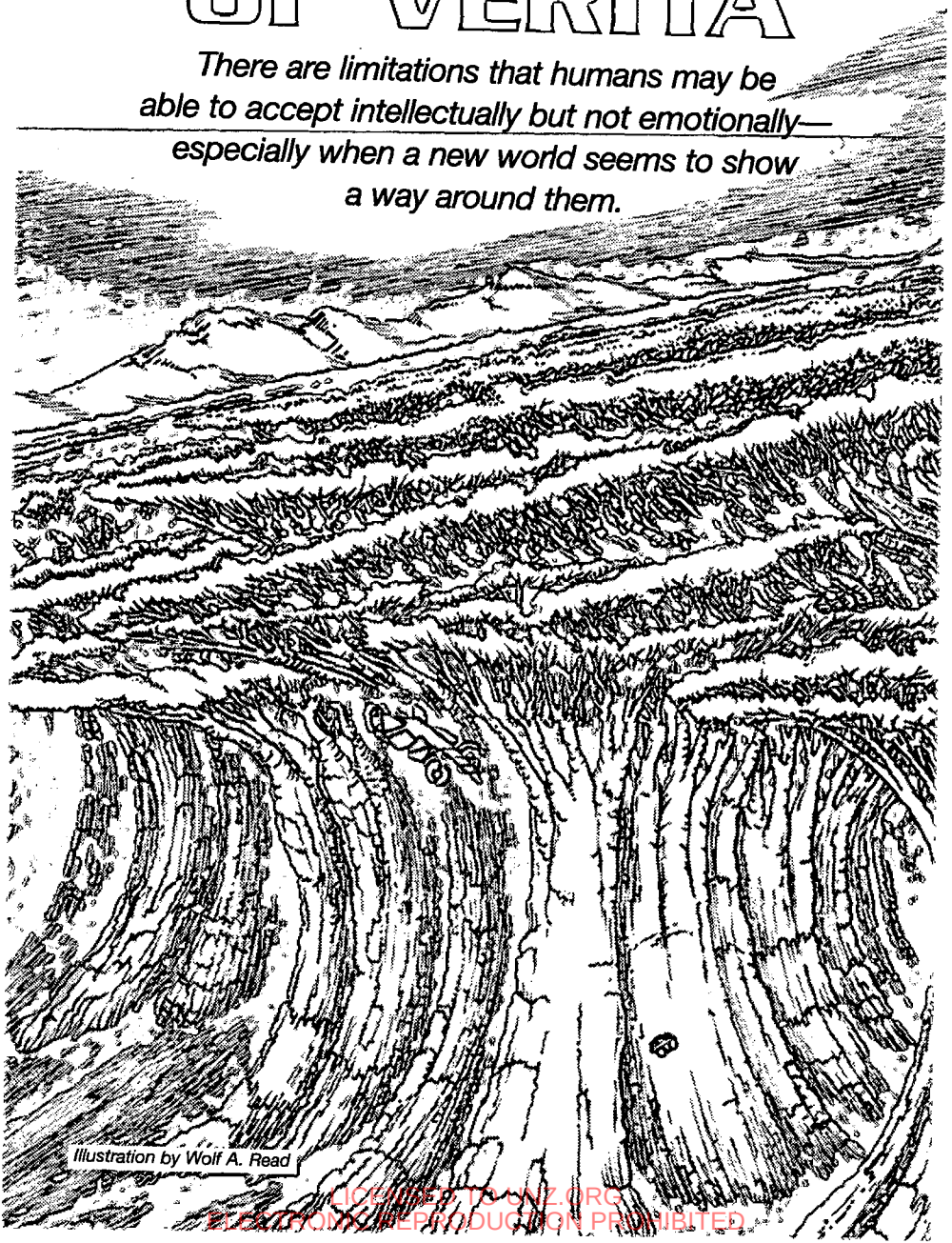

Illustration by Wolf A. Read

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Because a star explodes, and a thousand worlds like ours die, we know this world is.
That is the simile: that what might not be, is.
—JOHN FOWLES

Excerpt from Encyclopedia Interstella *Version AD 2308: Summary of Planet Verità:*

Colony History: The first cybernetic survey of Verità was in 2236. First colony established in 2260. Current population: 65,944. Verità is primarily a scientific colony.

System Primary: "Rubino," once called Lacillae 9352. Rubino is a 5.7 billion-year-old M3V main-sequence sun located 11.7 light-years from Sol.

Physical Stats: Verità's equatorial radius is 0.523 E, mass 0.112 E, and surface gravity 0.408 E. About 65% of the surface is covered by oceans.

Orbital Position: Verità is a second-order world circling Capire, a Jovian of 1.08 Mj with a semimajor axis of 0.128 AU and a 49.78 standard-day orbit about Rubino. Verità's semimajor axis is 120,730 km, with an orbital period of 0.559 standard-days. Sidereal day length is 13.558 hours. Axial inclination is 0.1 degree, about equal to Capire's.

Atmosphere: Sea level pressure is 3.05 bars. Breakdown of constituents is N_2 0.908, O_2 0.08, Ar 0.01, CO_2 0.0025. Verità's deep atmosphere is maintained by a strong internally generated magnetic field, and there is little ablation due to Rubino's weak solar wind.

Rubino Flux At Verità: 0.105 E on average. Due to Capire's slight eccentricity, Rubino flux at perihelion is 0.108 E, and at aphelion it is 0.101 E. Verità's orbit about Capire also causes a 4% variation in flux during one-half a Verità day. A permanent ice age is offset by a high geothermal heat flow; tidal stresses between Verità and Capire generate the strong internal heating. The deep atmosphere, with significant CO_2 from volcanism, also provides an insulating blanket. Latitudinal temperature differences are minimal, often making for weak midlatitude storms despite a strong coriolis force.

Biosphere: Ancient carbon-based multicellular and unicellular lineages, with aquan, terrestrial and aerial ecosystems. Terrestrial and aerial multicellular clades have unusually low diversity, probably due to cold average surface temperatures and weak insolation; both factors reduce photosynthetic activity, making little available energy for the entire food pyramid.

Nomenclature: All primary and secondary worlds have names in Italian. Verità means "truth," Capire means "understand," and Rubino means "ruby."

The Story of Debbie della Cava

After Mom died in the earthquake, Rebecca fell into deep depression, and Debbie made every effort to help her younger sister overcome the sorrow. When Rebecca ran off to escape the sad memories, Debbie followed.

Fighting off tears, Debbie stepped out of the shuttle exit tube among a group of fellow travelers, walking into planet Verità's sole space terminal, a spacious dome room with potted plants climbing up the curved walls. The dome's clear panels provided a view of a broad river valley littered with rounded boulders and scattered shrubs. Tall, jagged mountains loomed in the distance, partially obscured by the glittery spires of the nearby colony arcoplex. Not used to the planet's Mars-like gravity, Debbie felt like she almost floated across the floor, even in her lethargy. She'd lost some muscle mass during the long trip.

During her interstellar journey, Deb-

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bie had aged a few months at worst, for cryogenics slowed her physiological processes down. *Nearly twelve years have passed,* Debbie reminded herself for the umpteenth time since she had awakened. *So I'm thirty-two in years relative to Earth, twenty in my subjective frame.*

She had recovered from the long sleep in six Verità days. During the recuperation, she often ruminated over the fact that Dad was now over a decade older, when it seemed like she had only said goodbye to him a few days ago. She wished beamed propulsion were faster—but the light-speed barrier was one of the few things in the Universe that seemed truly insurmountable. A cold, painful reality when it involved long separations between loved ones.

Debbie rubbed the water from her eyes and, trying to get her mind off of the past, watched the people in the room. Many stood in clusters, or sat on curved benches in front of the windows, talking calmly among themselves. They read maps and directions flashing from holographic signs that floated midair, or used their wristcoms, trying to find their quarters, job locations, entertainment, or all three.

One bright, colorful sign kept flashing information about a supernova party.

Oh, yeah, there's a supernova! she thought. Over a decade of sleep, and anything can happen.

She glanced up through the broad skylight and turned in place, looking for a bright star. The dome's clear ceiling revealed a dark blue, cloud-free sky. Like a giant smile, Capire's large ruddy crescent sliced through the blue field, full of the turbulent bands and eye-like storms typical of gas giants. Sinking close to a horizon of rocky hills opposite the mountains, Rubino's broad disk shone warmly, turned purple-red by atmospheric dust. She found the supernova sitting just above the eastern horizon, a pinprick of blue-white light so intense that it was painful to look at.

I wonder what Rebecca thinks of it? She lifted her wristcom to her mouth, and paused. *Should I call her? Maybe. What's she going to think of my arrival?* Before she decided not to, she pressed the send button. "Rebecca della Cava."

After a brief hesitation, the wristcom reported, "Rebecca della Cava is not responding."

Furgle! "Can you tell me where she's at?"

"Currently," said the cyberadministrator in its polite male voice, "she's living at the Grand Stand Field Ecology Station."

Surprised by the information, Debbie lifted her eyebrows. A research station was the last place she expected Rebecca to be. She'd been more interested in the arts than the sciences. "OK. How do I get there?"

"GSFES is located three hundred fifty-nine kilometers east of Verità Terminal, in the foothills of the Sierra del Fuego. The fastest method of travel is via a ducted-fan craft."

"I'd like a ducted-fan craft."

"A DFC will be waiting for you outside. Take the aviation exit and look for the DFC named, 'Opossum.'"

"OK."

Debbie hesitated. *What about my job?* Speaking into her wristcom, she said, "Who am I supposed to report to for work?"

"Pierre MacAndrew-Rojas-Vernon, at the Humpback Ridge Paleontology Site. He's expecting you."

"He is?"

"Yes. He chose you out of several candidates from the ship's manifest."

Debbie nodded, and wondered if Rebecca had also read the manifest. Maybe that's why Rebecca hadn't responded to her wristcom query. Debbie sighed, fearing that finding Rebecca might be a bit more difficult than she originally thought. *If* her sister real-

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ly was being evasive. Rebecca certainly hadn't taken herself off of the planetary directory.

Curious about her new supervisor, she asked the cyberadministrator, "I'd like to speak to him."

After a moment, Debbie heard a deep voice say, "Debbie, welcome to Verità!"

"Thanks. Wh—"

"I've got a new find where I can use your excellent digging experience." Pierre's voice sounded excited, like the new discovery was the most important in years. "We've uncovered a horizon that records a time period when Verità's species diversity dropped sharply—a reduction that hasn't recovered yet! And the layer looks quite old, maybe in the hundred megayear range. Why hasn't there been an adaptive radiation after the mass extinction, like we've seen on so many other worlds? Something about Verità must have changed back then, and it was big." He paused. "Sorry for going on like that. When can you be here?"

"Ah," she hesitated, thinking about Rebecca, but also eager to start the new job, especially with a new discovery underway. "Tomorrow? I'd like to take a quick look around."

After a pause, Pierre said, "Sure. Tired from the flight? It took me several weeks to recover."

"Wow, really?"

"Oh, my body recovered much quicker than that, but my mind . . . And they say we live in technology's greatest age! Anyway, take more than a day off, if you need to. The fossils have waited for millions of years—they can survive a little longer."

"Thanks," she said, becoming aware that Pierre was one of those people that liked rambling. Oh, well. An opportunity to learn.

"No problem. See you."

"Bye."

She lowered her arm and walked towards a large, arched exit labeled "Aviation Field." She couldn't help skipping, the gravity was so light. Air rushed past her ears as she moved, louder than what she remembered from Earth, and she could clearly feel it moving into her mouth with each breath. As she adjusted the straps to her backpack, she spotted a gigantic opening to her right, one that led into the arcology proper. Many people walked through the wide, inviting entrance.

Ahead, she saw the DFC through the clear arched doors of the flight deck. The broad, streamlined machine had four hooded blades attached to stubby wings; lift was easy to achieve in Verità's light gravity and thick air. "Opossum" glowed in pink lettering above the door. Opossum was not alone. A number of different flying machines waited silently on the landing field, their dark windshields staring at her like the emotionless eyes of insects.

The doors opened as she neared. She slowed to a walk and stepped into sharply cold air. She zipped the collar of her jumpsuit up to ward off the chill, and increased her pace. She noticed that she had two shadows, one a sharp-edged silhouette much squatter than she really was, and the other a fuzzy outline making her much taller and thinner. A gentle gust of wind fluttered her long, straight hair, and her double shadow responded in kind. She studied the sky again, glancing from Rubino's large fiery disk hanging low in the west to the brilliant point of light to the east, then back to her shadows. *Ah,* she thought, *the supernova is about as bright as Verità's sun.*

The DFC's door lifted without a sound as she neared the machine. She stepped inside the spacious, clean-smelling craft, unbuckled her backpack, and stowed it in an overhead luggage compartment. She took a seat in the front.

"Welcome," said Opossum, as safety belts closed around Debbie. "Head-

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ing to the Grand Stand Field Ecology Station."

Debbie nodded to Opossum's double-lensed camera, which hung from the cab's ceiling just above the windshield. She heard the whisper of dampened fan blades and watched the flat landing field drop away.

Under the dim light of the setting sun, and the brighter light of the supernova climbing toward zenith, Debbie watched titanic trees pass below. The trees were so big that a sense of scale was hard to achieve, but they appeared far thicker than the largest sequoia she'd ever seen, and easily as tall as the highest redwood. Their stout, needle-covered limbs reached skyward before spreading horizontally, like the flat anvil top of a thunderstorm. Visible between gaps in the branches, the trees' fat, exposed roots undulated from the tree's bole in irregular waves so large that they brought to mind the rounded hills of California District's old wine country.

Oversized cypress, she thought, though the resemblance was vague. Many trees had merged together, making for trunks easily as broad as they were tall, and she'd seen no cypress do that. She guessed the woods she overflew were the "Grand Stand" that Rebecca's field station home was named after.

She read a little about Verità's modern biology while preparing for the interstellar trip, and recalled the trees' name: megatrees. The biggest trees in explored space. She also learned that Verità had few animals, most of which were no larger than an ant. Quite unlike the abundant life of long ago, which included herbivorous beasts easily thrice the size of brachiosaurs and gigantic carnivores to match. Size wasn't the only thing limited in modern times—Verità's land-based species richness was way down in every category, from tiny subterranean root eaters to arboreal browsers, as was the flora from which the little creatures fed. Many paleobiologists hoped that the fossil record would reveal the reasons for Verità's permanent low diversity. She had taken advantage of her fossil digging experience to get onto the next vessel to Verità, and left Earth only two months after her sister. Debbie had grown tired of her six-year Mt. Diablo study anyway. Rick, a colleague, was happy to take over for her—he loved the area.

Thoughts of California brought to mind Dad: he could live out a new career, and raise a new family, before she ever returned to Earth. By then, he'd be a different person.

Debbie suddenly felt an emptiness that echoed how she had felt when Mom died years ago. She had coped with the loss by caring for Rebecca. She spent years guiding Rebecca through her education, and helping Rebecca rediscover her lifelong interest in art. They were productive years: that energetic young sister of hers slowly returned. Mostly. Something was still missing. Maybe it was Rebecca's silence. She always seemed distracted, and rarely started conversations like she used to. And it bothered Debbie that Rebecca never showed much emotion about Mom's death, save the one time she cried out right after the earthquake. Rebecca held her emotions inside, refusing to say a word no matter how hard Debbie tried to get Rebecca to talk about her feelings—until Rebecca left her parting message.

Debbie looked at her wristcom. She lifted the device and said, probably for the hundredth time, "Play Rebecca's parting message."

Rebecca's likeness appeared on the small screen. Her rounded face was a little red, as she had been crying, and her dark brown eyes held a hint of sadness. Her straight brown hair was a mess.

"I . . . I'm sorry," Rebecca began,

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"but I just can't stay home anymore." She rubbed her nose.

"This place brings back too many memories of Mom. I still miss her. I've decided that I need a purpose. That's what's missing. A colony world has opened up to immigration, Verità, and I'm heading there. There may be a purpose for me there."

"I-I love you both, and I'll m-miss you." She looked down. "But I have to do this. Bye."

Rebecca's sad image faded away.

Though she could recite the entire message, Debbie still frowned as it ended.

She remembered Dad's calm acceptance after hearing the message. He said, "I hoped she'd pick a career close by, but if she wants to fly to another sun, then I won't interfere. She's reached far in her education and is free to do what she wants." That evening, he stared out the big living room window for a long time, gazing at the sweeping clouds with a deep frown on his face.

He'd never bothered to find another companion since Mom's death, and there had been a bit of a lonely air about him since. That loneliness was never more pronounced than at that moment with him staring at the sky.

"I'll miss her," he then said. "I hope she finds time to send one more message before the *Santa Maria* leaves."

Rebecca hadn't.

Maybe all of Rebecca's pent-up fear and sadness had finally taken its toll. Maybe leaving for Verità was Rebecca's way of showing a need for help. Debbie wasn't sure. All she knew was that she could not ignore a sister who might be in need—a painful choice, for she didn't want to leave Dad alone during a difficult time.

She checked her wristcom—about twenty minutes had passed since takeoff—and wondered if going directly to Rebecca was the right thing. Maybe she should go to the paleontology site and get acquainted with Pierre first, rest a bit, and then leave a note on Rebecca's voice mail about her arrival. No. Rebecca was too important to wait for, and a recorded message was too impersonal.

She let out a nervous sigh, and studied the blue-white highlights on the dash. Reminded of the new "sun" in the sky, and looking for something to take her mind off of Rebecca and Dad, she looked up and asked, "What's the news on that supernova?"

With a cheerful voice, Opossum said, "It's an unusually dim white dwarf, called Sundiver, that has exceeded the Chandrasekhar's limit by coalescing with a brown dwarf, now called Splash. This is known as a Type I supernova, though it's peculiar because most Type I events are the result of a white dwarf gravitationally stealing mass from a star that it orbits. The collision happened eight-point-seven light-years away, and the resultant supernova has currently attained a brightness of four-point-nine percent that of the Sun as seen from the Earth—that's a visual magnitude of minus twenty-three—making it about half the luminosity of Rubino as seen from Verità.

"Things are warming up here. Some of Verità's inland regions have been experiencing record highs. And storm systems are becoming stronger than usual. We'll be grazed by a rapidly developing front later today."

Warm? Debbie thought sarcastically, remembering the chilly air on the flight deck.

"Is the supernova visible from the Earth?"

"Not yet. Rubino is roughly between the Earth and the supernova. It'll be about eleven years before the supernova's light reaches the Sol System."

Debbie nodded, realizing that if she went back to Earth soon enough, she'd see the tail end of the supernova there, as her near light-speed vessel "slowed" down the star's progress. She'd be able

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to speak about the supernova with Dad like it were as new to her as him, even though she'd seen it twelve years before he even knew about it. Strange.

Looking to her left, Debbie saw jagged, snowy volcanic peaks, a sight becoming quite familiar. *Sierra del Fuego*, she recalled from the information that the Verità cyberadministrator had said over her wristcom. To the right, beyond a coastal strip of barren hills, the water of an ocean made a nearly flat indigo plain. She could just perceive a curve to the horizon, as if she were viewing the ocean through a weak wide-angle lens. A few wispy clouds reached above the curve.

She turned her head and studied the volcanoes, idly wondering if any were going to erupt soon, considering how active Verità was geologically. Megatrees densely covered the foothills, reaching halfway up the tall peaks before giving out to cold, gray rock. The gigantic, unmarred trees suggested things had been peaceful for quite some time.

She tried to peer through the forest's dense branches. Somewhere out there was GSFES, and Rebecca.

Rebecca, I hope you're OK. At the thought, she couldn't help the childhood memories that welled up . . .

Light snow fell from a cobalt sky. Debbie watched the flakes sift through the bare, gnarled limbs of stout oak trees as she breathed cold, biting air. Holding her frozen hands tightly in the pockets of her jacket, she paced down the old forest trail toward the staging area where an aircar awaited to return them to the Oakland-Berkeley arcology, and Mom's warm hugs.

Her little sister Rebecca, already excited about the prospects of her fifth birthday tomorrow, ran ahead, screaming gleefully. "Snow!" She held out her thin arms and spun around. Her long brown hair flittered about her head.

"Yes, Rebecca. It doesn't happen very often in the Berkeley Hills." She'd only seen snow once before in her nine years. Admittedly, she couldn't remember her first two years very well.

Rebecca skipped about. "I want it to snow forever!"

"Be careful, Rebecca. You could trip over a branch or rock doing that."

Rebecca ignored her, and kept skipping. Her hair and jacket snapped to her fast rhythm.

Abruptly, Rebecca stopped and stared at a furry lump laying on the hiking trail. "Why's the rabbit not moving?" she said with a concerned voice.

Debbie stopped next to the prone rabbit. Its blank, open eyes seemed ghastly. Snow had begun to accumulate on its cold fur. "Because it's dead."

"What's dead mean?"

Debbie groaned. "That's a difficult question." How to explain it to her? *"When something's dead, it's like it's asleep, except that it never wakes up again."*

Rebecca looked up at her. "Never wakes up? How come he wants to sleep that long?"

"He can't help it. You can't choose to stop being dead. It lasts forever."

"Oh. Can everything die?"

"Yes, everything living dies."

"Even people?"

"Yes."

"Oh. I don't want to die." She looked afraid.

"Nobody does, Rebecca," she said to her glum sister. "Don't worry about it. You'll easily live a hundred more years before you die."

"Years last forever!" Rebecca said cheerfully, and ran from the dead rabbit. "Maybe we can make a snowman soon!"

The snow fell heavier, sticking to frozen tree branches and blades of yellow grass.

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* * *

"We've reached the Grand Stand Field Ecology Station," said Opossum

The low hum of the fanblades changed pitch and Debbie felt a gentle forward pull from negative acceleration. The craft passed through a gap between the megatree branches, and dropped into a forest darkness not aided one bit by the distant sun and more distant supernova. Running lights flickered off of tree limbs so tall that they could have been castle towers.

A white light erupted outward from the front of the craft, penetrating deep into the wood. She saw the forest floor, a carpet of brown needles that undulated over and around the megatrees' vast roots. Nothing grew, save the megatrees. Considering the absolute darkness at the forest bottom, she could understand why.

Debbie spotted a few dim lights ahead, before the craft's brilliant beam overpowered them. *GSFES,* she thought.

The field station was nothing more than three small domes placed in a triangle, all linked together with open walkways. A broad ducted fan sat in the middle, and lesser fans were spaced evenly around the outside periphery of the triangle, ready to move the entire station when the need arose. A sizable lanai swept around a dome which had all its lights on.

She peered into the field station's windows, trying to spot Rebecca inside, and shivered nervously.

The DFC set down, throwing up a cloud of dry needles.

"Debbie," said Opossum, "would you like me to wait?"

After seeing her sister, she'd require transport to her quarters. A thirty minute wait was not very appealing, so she said, "Yes."

The DFC's humming engines mumbled and silenced. Old needles fluttered downward in the headlight.

"I'll be shutting down the exterior lights," said Opossum, "so please take a flashlight. They are located under the rear seat."

Debbie nodded and stood up. After a brief stretch, she walked to the back of the craft, still feeling unusually springy in the low gravity. She lifted the bottom cushion of the rear bench seat and saw various flashlights. She grabbed a medium width lamp with a headstrap. Securing the light to her head, she turned toward the door. The hatch lifted. She stepped outside, into cool air with a sharp pungent scent.

"Debbie," called a familiar voice from the porch, "is that really you?"

At the sound of Rebecca's voice, Debbie froze.

With all the enthusiasm of the sixteen-year-old that she was, Rebecca dropped the large digipad she carried, ran across the porch, leaped onto the soft needles and embraced Debbie. "I missed you!"

Shocked by such a warm greeting, Debbie hugged her sister awkwardly in return. She noticed that Rebecca was taller. And a bit leaner—she'd obviously spent time doing some kind of physical activity. *Walking, of course,* Debbie thought.

The DFC's light winked out, leaving them in a blackness only broken by the diffuse light from the research station's windows.

Debbie reached up and switched on her headlamp. The bright light revealed Rebecca's cheerful brown eyes. She was dressed in a loose half-sleeved tunic cinched at her waist with a broad belt, and baggy shorts. Sandals were attached to otherwise bare feet. Debbie saw the glittering jewels of the bracelet she made for Rebecca's fourteenth birthday shining from her sister's wrist, and smiled.

"It's good to see you, Rebecca."

Rebecca nodded and studied Debbie, looking her up and down while maintaining her grin.

Frigid air stung Debbie's cheeks.

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"Aren't you cold in those summer clothes?"

"Nah. You get used to it after awhile."

Debbie nodded, thinking, *There's no way I'm going to get used to it.* With an inquisitive tone, she said, "You didn't respond to my wristcom message."

Rebecca studied her. "Having a wristcom takes away any sense of isolation. I don't wear mine much."

Debbie nodded and noted the change. As a small child, Rebecca liked her wristcom because it kept her in close contact with friends and family. Of course, out on a new world, a wristcom would be useless in those terms . . . until she had new friends.

"Still haven't stopped worrying about me," Rebecca commented in a matter-of-fact tone. Before Debbie could reply, Rebecca said, "So, how was Dad when you left?"

Debbie paused, wishing she could get Dad's lonely image from her mind. "He misses you. But he accepted your decision to leave."

Rebecca glanced away, looking guilty. "Yeah, I miss him too. Funny how that works—when I decided to leave, I didn't think I would miss him as much as I do."

Debbie stood silently, wishing that she could have convinced Dad to come along. Then they'd all be together again. But he had his lifelong interest in the ecosystem of the Sierra, and did not want to leave.

Rebecca looked into Debbie's eyes. "That's all history now, huh? Twelve years ago. Dad must be over us. Interstellar travel can be so . . . so difficult."

Fearing that she would cry again, all Debbie could do was nod. Though she felt Rebecca's comment was somewhat uncaring, Debbie had to admit a part of her wished the same thing for Dad. If he was "over them," then he must be feeling better, right?

Rebecca studied Debbie and frowned. She looked over Debbie's shoulder. "What craft did you fly in?" She walked around Debbie.

Debbie turned and opened her mouth to speak—

Rebecca exclaimed, "Oh, you came in Opossum! Opie's a cool DFC. He's more playful than the others." She bounced inside. The interior lights switched on.

Before following her sister into the craft, Debbie walked onto the porch and picked up Rebecca's digipad. Rebecca always was a bit careless, a reflection of that carefree attitude she had.

Carrying the digipad, Debbie turned and walked into the DFC. She savored the warm interior.

"Hey, Opie," said Rebecca, "you still afraid of hanging from a tree by your tail?" She sat in the pilot's seat that Debbie had previously occupied.

"I am not equipped for that function."

"Yep, I thought so," she said sarcastically.

Debbie walked to the front of the craft.

"However," said Opie, "I've deciphered your reference. I'm no marsupial, and I don't have a tail in the vertebrate sense of the word."

"Aw," she chided, "can't we figure something out?"

"Not any time soon."

Rebecca looked at Debbie. "Let's go for a flight. There's so much I want to show you!"

Debbie, a bit tired of flying, almost said "no." But Rebecca seemed more cheerful than she'd been in years—this was in strange contrast to the downhearted good-bye message she had left when she ran off. Afraid of dampening her sister's bright mood, and curious about her sudden mood swing, she said, "Sure." At least it was warm in the craft. She sat in the seat next to Rebecca.

"All right, Opie. To the Giant."

"Yes, Rebecca." Opie's engines moaned to life, and the craft smoothly

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lifted towards the thick forest canopy.

"What's the Giant?" asked Debbie as she held the digipad out to her sister.

"Thanks." Rebecca grabbed the tablet and set it on a canted shelf below the dash. "The Giant is the biggest tree in the Grand Stand. You won't believe it, even when you see it."

"Oh."

"You know what they're called?"

"Yes. Megatrees."

Rebecca smiled. "Anyone tell you why?"

"Because they're so big?"

Rebecca shook her head. "Not quite." She gave Debbie a serious stare. "It's how old they are. Three million years!"

"Three million? How's that possible?"

"No one is sure. That's what my roommate, Josh, and other ecologists are trying to figure out. All we know is that these trees do not die."

Light flashed into the window as they lifted above the treetops and headed northwest, toward the higher foothills. The sun had set, and by all rights it should have been night, but the supernova still shone brightly.

Rebecca looked up at the intense star. "That thing's been throwing off my sleeping schedule for several weeks now. It's especially bothersome when I'm camping in the more open country to the far north."

Debbie nodded and, trying to grasp the idea of a three-million-year-old life form, looked at the megatrees. Like buildings in the primitive sprawling cities of centuries past, the megatrees passed below, their massive limbs spread out in neat rosettes, making them appear like giant hands cradling the sky. The trees seemed to have changed color . . . slightly yellow near the tips of the branches. An extremely subtle effect, one that she could have missed before.

Debbie said, "What do you mean 'the trees do not die'?"

"They're all the same age," Rebecca said with an excited tone. "Three-million-one-hundred-forty-seven-thousand-six-hundred-fifty-three standard years to be exact. These trees were old when the Ice Age started on Earth!"

Though Debbie had her ideas, she asked, "How do you know their age so well?"

"An old technique, I guess. Bore a tiny core from a tree, and count the rings. You need a powerful microscope for the task, by the way. Because megatrees grow so slowly, the rings are tiny. They're not very pronounced, either. The orbit of Capire is slightly eccentric. Just enough for a weak seasonality here at the Grand Stand, one that makes for faint growth rings."

"Haven't you found any dead ones?"

"No," said Rebecca with uncharacteristic seriousness. "The trees do not burn well when lightning strikes them: they diffuse water into their bark to keep it moist. And, if the bark does catch fire, say during a drought, the meters-thick coat shields the living cell layers.

"Megatrees have easily survived hurricane-force winds—you should have seen that storm three weeks ago. Fifty meter per second gusts and the trees didn't shed a limb."

She looked up wistfully, and said, "That was so fun. Josh and I set up the wind sensors together."

Looking back at Debbie, she said, "The trees have even been buried in big rock slides, and the trunks still send up shoots. They store energy in their roots, as carb-carbo-h-hydrates. I can never quite remember that word! It allows them to quickly repair damage from cataclysms."

Shocked by the enormity of the information, Debbie stared at Rebecca with her mouth open. "Aren't there any saplings?" she finally managed to say.

Rebecca shook her head. "In fact, we haven't seen a megatree produce flowers. They just add a needle or two

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each Capirean year—that's fifty Earth-days. Josh said the average leaf lasts over a millennium before falling. He thinks the slow growth is due to the low light level. The rate of photosynthesis is related to the amount of light a plant receives, which may explain the trees' age. They probably have to live a long time to reach maturity."

Debbie wasn't sure whether to be more surprised by a Rebecca who seemed to be happily getting on with her life, or the trees' grandiosity. *Is my trip here wasted? Did I leave Dad for no good reason?* She felt hollow.

Curious about Rebecca's change, she asked, "When did you become so interested in the sciences?"

Rebecca studied her. "Well, I'm still not, really. When I heard about the megatrees, I wanted to paint them. Josh was willing to house me in a spare room at GSFES, and so I stayed, and have been painting since. Can't help but learn things when you're around so many ecologists."

"Oh. You'll have to show me your paintings when we get back."

"Yes. I think you'll like them." Rebecca glanced at her digipad. "I've scanned a few in high-res, but the pad's not like seeing them in person."

"Oh, let me see one."

"All right." Rebecca eagerly lifted the tablet and tapped on its flat face. "This is my most recent one—the harsh supernova light adds a unique quality to the woods, producing sharp shadows and strong contrast. This painting stands out among the rest." She handed the tablet to Debbie.

A photorealistic rendition of Megatrees at night, strongly accented by the supernova's light, literally jumped off the bright billion-pixel screen. The sinister-looking trees seemed to cringe away from the brilliant point of light in the purple-red sky, suggesting the illumination were too strong for them, or somehow poisonous. Debbie had never seen Rebecca paint something so dark, not even right after Mom died. "Uh, this is well done, but . . ."

Rebecca looked at Debbie intently. "Yes?"

"I'm not used to seeing such grim art from you."

Rebecca lowered her brows. "Grim? The supernova's beautiful! Some people just can't read art, I guess." Rebecca quickly grabbed the digipad from Debbie's hands. "Maybe you'll like it better when you see it in person."

"Maybe so," said Debbie, trying to appease her indignant sister.

Rebecca placed the pad back on the shelf, and quietly looked outside.

Debbie followed her gaze. Giant treetops marched past. Lines of ghostly clouds drifted in from the west, some sweeping overhead like titanic feathers floating across the sky.

Rebecca turned toward Debbie. A familiar mischievous grin erased the angry look from Rebecca's face, and she said, "I've spent time learning other things, too."

"Like what?"

"You never did tell me what it was like that time you were supposed to be studying paleontology with Rick."

Recalling when Rebecca had stumbled in on them working on more pleasurable things than paleo in her bedroom, Debbie blushed. "That's personal!" Giving Rebecca a serious look, she added, "Besides, I saw no value in telling you any more about it than what you saw."

"Well, I know what it's like now."

Debbie lifted her eyebrows. She felt a little jealous. She hadn't had the time for relationships and love-making since her first encounters with Rick. Mother had died shortly after the embarrassing incident, and she had Rebecca to watch out for.

"Wonderful how you can get lost in sex," Rebecca said, staring into the woods. "Forget your worries, forget about life."

Debbie didn't have to ask to know

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that Josh was her beau. She recalled Rebecca's happy little childhood smiles. "You've changed so, from that giggling baby sister of mine."

"Yes," she stated, "I have."

"We've reached The Giant," said Opossum.

Autumn leaves crunched under Debbie's feet, making a rasping sound, one that sometimes reminded her of dry bones being rubbed together. Foliage fell from the oak branches, and leaves scraped through her hair as they spun in a cool north wind. The bright sunshine could not keep her warm, even though she wore a thick coat.

Rebecca walked alongside, carrying her lightweight digital art pad under one arm, while looking at a bejeweled bracelet that Debbie had made for her recent tenth birthday. "It's really pretty," she said.

Smiling from the appreciation, Debbie said, "Welcome to the double digit years."

Rebecca glanced up at Debbie, her brown eyes and sharp-chinned face looking serious. "What's it like to be a teen?"

Debbie thought about the change. She liked the way her body was shaping up, and had fun experimenting with new types of clothing to accent her best-developed features. However, increasingly challenging schoolwork took much of her time, as did her newfound paleontological field work at Mt. Diablo, and the educational field trips she led through the paleontology sites. She liked learning, teaching, and digging fossils from the rock, but those tasks consumed most of her energy. Not much time for play anymore. Less play seemed a fair trade for more responsibility, but she still missed the joyous escapades she often had had with her friends—a period in her life years gone, when she had more flexibility in her education.

"Being fourteen isn't much," Debbie finally responded. "I liked ten better. Being little can have its advantages."

"Yes." Rebecca smiled. With a mischievous look she said, "Sometimes I don't want to grow up, and get big hips like you're getting."

"You tease!" Debbie reached out to tickle Rebecca's sides.

Rebecca ran away, giggling.

Not feeling like expending the energy, she let her sister go. Rebecca's right, though, *Debbie thought. Debbie had outgrown all her clothes from last year. Not by much, but it was noticeable.*

Rebecca pointed down the hillside, and said, "Look at that tree!" She walked off the trail and stumbled through the leaf cover toward the massive oak. It had fallen heavily across a dry stream, and its thick branches had shattered from the impact. Sharp splinters and busted twigs were scattered haphazardly throughout the forest.

"It probably fell in that wind last night," said Debbie. "Remember? Mom thought it was going to rain."

"Yeah," said Rebecca, "she sure was wrong."

Debbie followed her down, being careful not to trip over old branches that the crackly leaves might be covering. A sweet smell filled the air, one that reminded her of the freshly cut lumber she got for a woodworking project.

Rebecca walked down the trunk to its empty stump. Fingerlike splinters stood up from its gaping wound, mimicking an outreaching hand.

Looking concerned, Rebecca said, "Just think, this tree lived for centuries. Now it's dead, because of a single gust of wind."

"Yes."

"Kind of sad, don't you think? No matter how long you live, your life still ends."

Is there fear in Rebecca's eyes? "*Yes.*"

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"There must be something that lives forever!" Her words had an urgency to them, like she was very afraid.

For fear of making her feel worse, Debbie refrained from saying anything. She wondered if anyone would find the elusive answer to immortality. From what she had learned about the search, she doubted it. Aging wasn't a problem solvable just with genetics, for some of its deleterious effects were the product of living in an oxygenated environment. And even if oxidation could be dealt with completely, how do you make the mind last forever? Recording the information digitally would create more problems than it solved. The brain, by its very nature, had to be mutable, had to be able to delete old information for new—giving animals their behavioral adaptability. Maybe a body could be made to live a long time, but not the memories, the behaviors, or the persona. That would be lost, to time. Death in a different sense.

"I don't like this place. Let's go find a more cheerful spot." Rebecca climbed back up the hill and disappeared over its lip.

Listening to her sister's fading footsteps, Debbie stared at the broken tree.

"All right!" Rebecca looked down at the forest below the windshield.

After studying the dense vegetation, Debbie realized the "forest" was actually *one* tree. A tree with a trunk so broad that it surpassed the scope of her vision, yet it was no taller than the lesser megatrees, maybe a hundred and twenty meters high. From what she could see, the overall shape of the the Giants's cross section was irregular, undulating in deep canyonlike recesses and bulging out in vast ridges of wood, making it appear like a huge, fuzzy starfish. *Or a giant amoeba,* she thought, for it was not symmetrical like a starfish. At her best guess, the tree covered scores of square kilometers of ground. On the scale of Verità, the huge tree was like a lichen growing on a boulder—if it had any modicum of consciousness, it'd have a feel for what curvature meant on a planetary level. And be able to tell the tale of three million years.

This tree's so large that I amount to nothing compared to it. Nothing. In terms of age, I'm not even worth a needle, let alone a twig.

"I love flying around the Giant," said Rebecca. "Opie, give me the controls."

"Yes, Rebecca."

"Thank you, M'lord."

"You are most welcome, Milady."

Debbie looked at Rebecca. "You said 'thank you' to a DFC?"

"Certainly." She grinned. "We like to play." She pushed forward on the H-shaped steering wheel and the craft lurched downward. They sank into the woodsy darkness. Opie's bright headlight flashed on.

Debbie's heart jumped. She'd never been in a DFC with a human at the helm before—let alone her kid sister. "You're not going to fly this thing in the forest?"

"I sure am."

"That's dangerous!"

"I've gotten OK at piloting in the past month." She gave Debbie a casual glance. "Only a scrape now and then."

"What if the next scrape is worse than that?"

"Are you kidding? I haven't had time to *really* learn how to fly one of these." She flashed a smile. "Opie's looking out after me." She glanced at the DFC's dual camera eyes. "You won't let us crash, will you, Opie?"

"Not if I can prevent it."

"There. See. He loves me."

Shocked, Debbie said, "Loves you?"

Opie replied, "I can't actually confirm the presence of love in my circuits. But I'll keep you two from getting hurt."

"Sounds like love to me," said Rebecca. She steered the craft below the

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megatree's redwood-sized branches and skimmed close to its warped, rough-barked trunk.

To Debbie, the ridged wall of plated bark seemed more like a cliff than a tree. Maybe it was because the light showed just a small portion of the trunk, and she could get no sense of shape or the total extent of the tree. She had a hard time thinking of it as a living thing.

Trying to keep her mind off the fact that Rebecca was steering, she asked, "Is it just a single tree?"

"Nah. Definitely a merge. No one's given it a full count, but it's a big number. Over a thousand, certainly."

Debbie wondered about the limited height of the the Giant in light of its great age and girth, and immediately had a strange vision of the trees of Verità growing up all the way to Capire. She blinked the funny image away, recalling that Earth's trees were limited in stature because they drew water by capillary action. A water molecule chain could only be made so long before it became unstable, and that length nearly equaled the tallest redwoods. Maybe Verità's trees utilized the same method.

Rebecca banked the DFC towards the Giant.

Debbie saw that they were heading towards a narrow gap in the The Giant's wood, one that seemed to lead into its trunk. She gripped the seat rails tightly.

"Here we are," said Rebecca as they passed through the gap. "The Amphitheater. The Giant surrounds us, save for the narrow passage that we just flew through. It's hard to see, because of the dark." Rebecca lowered the craft. "It's named solely for its shape; it's crappy at carrying sound. The bark absorbs it."

Debbie stared out into blackness. A few splotches of diffuse supernova light sifting through the tree's branches were scattered about the ground and on one wall, but they gave her no sense of the Amphitheater's size.

The DFC touched down. Their restraints pulled away as the engines quieted.

Turning toward Debbie, Rebecca said, "This is my favorite spot. I wanted you to see it—or *not* hear it, anyway." She stood up excitedly and walked to the exit.

Feeling overwhelmed by Rebecca's energy, Debbie silently followed.

They walked outside together. A strong pungent smell made Debbie feel like sneezing. Fighting off the urge, she turned on the headlamp she still wore. She shivered in the cold, even in her field jumpsuit. She could not believe Rebecca was comfortable in her light clothing.

After walking several meters from the craft, Rebecca sat on the bench-sized end of a massive root. Behind her, the root-bench slithered up into the darkness beyond the lamp's beam. "Sit. And listen."

Debbie complied, feeling the cool wood on her rump.

"Turn off that light. It's distracting."

She shut it off, and watched the blackness close around her. It wasn't long before she realized that she couldn't hear anything. Silence, more absolute than the dark that surrounded her. If it weren't for the root she sat on, she could have believed she was floating free during the Universe's tired, cold end, with all things long faded away. No more sensation, no more feeling. Just the sound of her own exhalations, and the gentle heartbeat pulsing in her ears. She strained to hear something else, and imagined her ears reaching into the dark, trying to feel for sounds in a blackness that seemed to be a physical substance. She discovered that she could hear Rebecca breathing. Her sister's breaths whispered from the dark, a faint rhythm marking time in a place that otherwise had no time.

Debbie had not heard that sound

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since she was young, when she shared a room with Rebecca, who was afraid to be alone when she was little. Debbie often woke before Rebecca, and lay in bed, listening to her sister's steady breathing as the sun rose, illuminating the walls with a cheerful glow. Such a peaceful and innocent sound. A sound that she still missed, she realized. She never did sleep the same once she got her own bedroom.

Debbie frowned and stared into the blackness, mentally counting off Rebecca's breaths and wishing she could regain those lost childhood moments. Her main concerns had been simply the next school project, or when she'd see Rick next, or her next hike with Rebecca, or what to do on her days off. Not the new responsibility for Rebecca she had after Mom died.

Those were happy moments that happened over two decades ago, but what did those tiny little decades mean here, in this dark place that appeared to have no time? Three million years of darkness so absolute not a thing could grow—an environment controlled entirely by trees so grand, so massive, that they probably depressed the planetary crust they sat on. Eternity could mean anything here: a million years, a month, a minute. It made no difference in such an isolated and forgotten place.

A place nearly forgotten by time, where moments were marked by the slow fall of old needles, an irregular beat gradually ticking away on a millennial level. At the caress of a zephyr, *plink*, a single thin leaf a hundred times older than she would fall, gently drifting down in the deep atmosphere, eventually to land—the tiny impact easily marking the loudest noise for an . . . an *eternity*—and adding itself to a slow accumulation of foliage that had persisted so long that it must be meters deep.

Or was it? Maybe some kind of decomposer slowly ate away at the discarded foliage, a funguslike thing that probably lived as long as the megatrees. She imagined the hypothetical fungus being something that spread a meter or two every ten or twenty thousand years, methodically consuming the discarded foliage only centimeters below her feet, an organism so patient that it took a hundred human generations to break down a single needle in the perpetually chilled soil. And the fungus's only chance of knowing time's passage would be through the gentle patter of its food. A thousand years a second, if that made any sense. Or a million years a minute. Verità's ancient life wouldn't give a care to humancentric ideas of time.

"Why did you come here, Deb?" Rebecca's voice broke the silence like a sudden gust of wind. Words that were immediately sucked away by the dark as each was spoken.

The words startled Debbie and broke her from her long trance. She hesitated. *How long have we been here?* It felt like an hour, but it could have been far less, or much more. She looked down to her wristcom, and saw only blackness. She did not light the device because of Rebecca's earlier reaction to her headlamp.

"Why, Deb?" Rebecca insisted. Silence immediately closed in.

"I . . ." *Is that what I sound like?* "Uh . . . to . . . to make sure you are OK."

Rebecca sighed, an absurdly loud noise in the dark. As if having physical form, quiet filled the space before she said, "What do you think? Am I OK?" She sounded irritated.

The darkness seemed to wrap Debbie in a tight cloak as she thought about Rebecca's question, and her breaths grew short. Rebecca seemed quite content, but the sudden change from the sad Rebecca she was back on Earth to a much more cheerful Rebecca on Verità still had Debbie worried. "Surprisingly so, I guess."

"You guess?"

"That letter you wrote—"

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"Sh!" said Rebecca. "Do you hear that?"

Debbie listened, and heard nothing. "What?"

"That popping. It's coming from above."

Debbie looked up into the darkness, trying to hear the sound. Eventually she did. The faintest crackling, like from a distant fire. Or the rustling of dry autumn leaves, like those that crunched underfoot long ago when she walked down the hill to that wind shattered oak.

She instantly recalled Rebecca's reaction to the dead oak, and the idea that nothing lived forever. The megatrees: "They don't die," Rebecca had said. Was she interested in the megatrees because of that idea?

I'm right, Debbie thought. *Rebecca's still running from her childhood fear of mortality.*

"I've never heard anything like that here!" Rebecca's words filled the void with urgency. "Let's go!"

Hearing Rebecca sprint toward the DFC, Debbie switched on the headlamp and ran after her.

"Opie, take us up!" said Rebecca as she sank into the pilot's chair.

He revved the fans as Debbie sat down.

Safety restraints closed around Debbie, and the craft lifted off. The downward pull of acceleration pushed her into her seat. "You said that you haven't found a single dead megatree."

Rebecca studied her. "No. Apparently, they can live forever."

"Three million years is a long time. Haven't there been any meteor impacts? Wouldn't that destroy them?"

"Josh thought of that. No large craters exist within the bounds of the Grand Stand. There have been many small strikes, and the trees have survived those. He said the smaller stones soft land due to atmospheric drag."

Debbie recalled that volcanic activity on Verità was more frequent than on Earth, and the megatrees grew right along the foot of the Sierra del Fuego. "What about volcanoes?"

"There are several places where lava has flowed through the Grand Stand. The trees, even though their bases were encased in stone, are still alive. Like I said, they don't burn well. Though severely damaged, they managed to pull through—probably their rootbound energy store. The same goes for those ash clouds—what do they call them?"

"Pyroclastic flows, I think. Still, how can you say they live forever, when they are just three million years old? The universe is much older than that."

"Yeah, kind of weird, isn't it?" Rebecca gave Debbie an intense stare. "They were all born at the same time, and no one can find evidence that a single tree has died since. It seems they were spontaneously created and given the gift of immortality."

Like gods, Debbie thought. "What about fossils?"

"None have been found. Of course, the trees could be seen as fossils, they are so old."

Not wishing to recite the technical definition of a fossil, Debbie nodded. *Besides,* she thought, *Rebecca has a point.*

Diffuse light flashed through the windshield as they broke through the canopy.

Rebecca looked out the window and gasped.

Debbie followed her stare and saw that the megatrees had turned yellow. Not so much the needles, but little round growths that hung from the branches' tips.

Shocked by the sudden change, she checked her wristcom—just over two hours had passed since she last checked the time on her flight to GSFES. How could the trees turn color so suddenly? Of course, she noticed some yellowing earlier. The trees probably

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began their alteration long before she arrived. Maybe decades ago. Maybe longer. But wouldn't the new growths have been noticed before this?

Maybe the growths started internally—people could miss that. The explanation did not help her anxiety. Things were simply happening way too fast. Never had she felt so out of control.

"Opie," said Rebecca, "take us over one of the higher limbs. I'm heading out for a look." She unhooked her safety belts and stood.

Opie drifted sideways, positioning himself over a many-forked branch that jutted out above the sea of foliage covering the Giant.

"Going out?" asked Debbie.

"Sure. I'd like you to come along." Rebecca walked to the back of the craft.

Debbie hit her belt release and followed her sister. "What are you going to do, walk on air?"

"You know better than that, Deb. Haven't you ever rappelled before?"

She shook her head, frightened at the prospect.

"That's right—I hadn't before I came here either." She opened the rear storage compartment and pulled out two ropes, two harnesses, and several other pieces of equipment that Debbie could not name. She handed Debbie a harness.

"Put this on, and buckle it tight. I mean *tight*."

Debbie worked at getting into the harness while Rebecca secured the ropes to three anchors built around the door. Rebecca finished with the ropes before Debbie had the unfamiliar harness completely on. Giving Debbie a slight grin, Rebecca stepped into her harness, her motions sure. Debbie followed her sister's lead, finally getting in her own.

When Debbie had finished tightening her belt, Rebecca handed her two things that appeared to be all handle. Debbie looked at them nervously.

"Those are Jumars. Getting down is easy. You'll need those to get back up. Hook them to your harness."

Debbie did so, and found a pair of gloves shoved into her face. "You'll need these as well," said Rebecca.

Putting on the gloves, Debbie said, "I don't know about this."

"We can't always lead our lives without risk. At least not if you want an interesting life." She glanced at Debbie and added, "Besides, rappelling is quite safe."

Rebecca picked up a rope and slipped it through a strange D-shaped metal piece at the front of Debbie's harness. She worked at the rope, twisting it in a candycane stripe fashion around the bar of the ring opposite the hinge, then yanked on it, testing the friction of the setup.

"OK," said Rebecca, "this is going to be awkward at first. But that's part of the fun." She grabbed Debbie's right hand and placed it on the rope behind her. Then she grabbed her left and placed it on the rope in front of the metal piece. Holding Debbie's right knuckle, Rebecca said, "Rappelling works by friction. Hold the rope tightly against your backside like this and you won't budge. Move your hand like this, and you'll slide down the rope." She moved her arm out. "The more you reduce the angle of the rope at the caribiner, the faster you'll go." Looking into Debbie's eyes, she said, "Don't go too far. The ropes aren't long enough to reach ground."

Debbie stared nervously at the setup.

"I know, it doesn't look like much. I was scared witless my first time, too. But the system works well, and it's easy to get the hang of."

"Don't you have some kind of powered winch, with a platform? Something that would make this easier?"

"I've seen things like that, as well as mobile platforms designed to get close to the trees. And, of course, you can always fly the research station, if every-

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one living in it agrees to have it moved. But I don't use any of those devices—rappelling is much more fun. Besides, the heavy equipment is all back at the field station. Ropes and harnesses don't take up much space, and researchers can keep them handy in all the DFCs."

Resigning herself to rappelling, Debbie asked, "What do I do next?"

Rebecca looked forward. "Opie the door." She grinned.

"Spare me," said Opie.

The door lifted, revealing the sweeping boughs of the Giant. Cold, pungent air poured in. Debbie looked down at the dark spaces between the branches. Her stomach grumbled uneasily.

"Stand with your back to the door," said Rebecca.

Debbie looked at her wide-eyed.

"It's OK. The rope will hold you."

Debbie slowly turned her back to the door.

"Now put your feet at the edge and lean back. Let the rope support you."

She leaned and let herself slide back a few centimeters. Feeling off balance, she wanted to throw her arms out and catch herself on the doorjamb. She resisted the urge, and stopped her backward fall by tightening the rope. She gave Rebecca a pleading look.

With an assuring smile, Rebecca said, "I'll be with you the whole time. Don't worry."

Sucking in a deep breath, Debbie let herself tilt further, going nearly horizontal. She stared up at a sky covered in silver clouds. The supernova shone through the veil, a diffuse point of light surrounded by a double rainbow ring. Capire's crescent was gone. Her heart raced. The DFC's fans whispered to both sides, canted outward to prevent strong fanwash directly below.

OK, Deb, she thought, *you're in control. Your butt is* not *hanging in the air above a tree so large that it could cover the entire San Francisco Bay.* But it was, and the only thing supporting her was a thin rope. She hesitated again.

Rebecca said in a sure tone, "Now, you're going to have to leap and let yourself slide down."

"How much?"

"Keep it gentle, and keep the fall in control. But make sure you've gone far enough down so that you don't hit the craft on a swing."

Debbie nodded and acted before she could tell herself no. For a brief moment, she felt weightless, and then she slowed her fall with a pull on the rope. The line whisked underneath her gloved hands, and stopped. She swung below Opie's belly, trying to calm her shivering arms and rapid breaths.

"Hurry!" On her own rope, Rebecca slid past Debbie.

She lowered herself in short jerks, watching the DFC's double winged silhouette shrink. The rope, grading upward to a fine line just before touching the craft, seemed too delicate to be holding her. She shoved the idea out of her head before she panicked.

"Deb, come on! I think the tree is blooming!"

Debbie looked down, and saw that she was almost upon the limb. It seemed like a tree of its own, growing from the ragged field created by The Giant's prolific branchings. This close, she could easily hear the crackling and rustling she had heard below in the Amphitheater, making The Giant seem full of rasping insects. Rebecca stood in the nook of a major division in the bough, her thin fingers gripping the plated bark as she reached out to a twig.

Debbie landed next to her, finding plenty of room for both of them. She hugged the rough trunk tightly, savoring its assuring solidity despite the painful ridges pressing into her. The air smelled of sweet sap, like from a stand of pines.

Rebecca pulled a twig toward her. It snapped off in her hands.

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"Funny," she said, "they're usually stronger than this. Until they're picked. Then they get brittle." She studied the little sample, plucking one of the yellow spheres off. "Definitely a cone." Shaking her head, she said, "In the colony's fifty standard years, nothing like this has ever been seen." Her eyes gleamed. "We're so lucky!" She handed the twig to Debbie.

Holding the stem in one hand, while still gripping The Giant's bole with the other arm, Debbie looked closely at the small scaly cones. One snapped, startling her, and she almost dropped the twig. The cone had just opened! She watched white powder sift from the scales. *Pollen,* she thought.

Rebecca was watching, and she smiled. "These trees never cease to fascinate me."

Debbie nodded, understanding.

A slight breeze picked up, swirling through the bough, and jittering the twig in her hand. She noticed the fluttering needles. Their tips had begun to yellow. She looked at the branches around her, and saw the same thing. *Is the tree dying?* She glanced at Rebecca, and her stomach churned nervously.

Debbie walked behind Rebecca, who looked quite nice in her loose-sleeved gray tunic and blue shorts—she wasn't into wearing jumpsuits, like Debbie. Mom, looking equally nice in her forest green pants and jacket, walked in the lead. Debbie whisked through tall green grass as she stepped on the familiar one-lane trail. The breadth of the flat space the trail followed—a steep shouldered berm that appeared to have been carved out of the hillside—suggested the trail had been wider sometime in the past. Probably a road, used back when people drove wheeled cars.

A warm zephyr tickled Debbie's cheeks, caressed her bare arms, and played across her exposed shins—she'd unzipped the sleeves and legs of her jumpsuit before starting the walk. Orangish rock exposures high above tantalized her—Grizzly Peaks's strongly bedded stone was probably an ancient seafloor deposit, and could contain any number of sea fossils. She resisted the urge to climb the hillside. Mom and Rebecca didn't share her love for paleontology.

She looked to her left, down a steep walled valley full of live oaks, Monterey pine and redwoods, squinting under the bright springtime sun. The Oakland-Berkeley arcology sat beyond the mouth of the canyon, on the flat San Francisco Bay shoreline. Full of glittery, window-covered spires, large greenhouse domes, sweeping verandas, forested rooftop parks, and broad aircar landing strips, the vast structure made its own miniature mountain range, one that appeared sharply crystalline next to the rounded, weathered rock of the Berkeley Hills. San Francisco arcoplex sat in the distance across the bay, its kilometer-high towers poking far above a bank of fog rolling through the Golden Gate like a giant tsunami.

A couple approached, holding hands. They offered a brief smile as they quietly walked past. Their black Labrador retriever happily crashed through the scrub oaks on the edge of the berm, probably hot on the scent of quail.

Following Rebecca and Mom, Debbie strolled from the open area into a dense stand of Monterey pine. Her sun-baked shoulders and head cooled in the soothing shade. The grass's height lowered in the dark forest, just tickling Debbie's calves instead of reaching past her waist. A hawk called in the distance. Songbirds sang to each other from sheltering shrubs. Treetops sighed under a westerly wind, and the sweet, heavy smell of pollen made her mouth water.

Rebecca noticed something, and

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ran ahead. Her ponytail bounced wildly over her back. She abruptly stopped and pointed to the right, into the trees growing up the steep hillside. "Hey, Mom, what's that?"

Mom stepped over a fallen branch and walked up to Rebecca.

Debbie stepped beside Mom, peering beyond the rough-barked trunks to see what Rebecca had found. She saw squared-off shapes protruding from the ground, making a large sunken box that was probably vertically aligned once, long ago, but had tilted over time. Lichen and moss grew on the material the structure was made out of—concrete, if Debbie recalled correctly.

"Oh," said Mom, "that's an old foundation."

Rebecca looked at Mom curiously. "A foundation?"

Mom nodded. "Probably from an abandoned house."

"A house? Houses are in arcologies, Mom."

Mom smiled, "Yes, Rebecca, that is true today. But it wasn't in the past." Mom lifted her arm and spoke into her wristcom. "Terry, give me an image of Old Berkeley." The home cyberservant complied, and Mom's wristcom screen glowed. "Take a look at this."

Standing alongside Rebecca, Debbie peered at the image at the same moment as her sister.

"There are so many buildings!" exclaimed Rebecca.

"Now," said Mom, "see how they cover the whole bay shore area, and even trickle up into the hills? People lived in their own little buildings back then, and they were called houses."

"They're covering a lot of ground." After scanning the picture, Rebecca said, "I wish I could have a house like this one." She jabbed her finger on a window-covered dwelling sitting near the top of the Berkeley Hills.

"Well, twelve-year-olds didn't often have their own houses back then," said Debbie, who had learned about this last year. "Their parents owned them. It took a lot of work to have a place like that."

"Really? Kids didn't have houses?"

"Yes," said Mom. "As a matter of fact, that society made kids conform to a strict age status ideology. You were expected to know certain things and assume certain responsibilities at specific ages, despite the fact that everyone develops at their own rates."

"That's awful," said Rebecca.

Debbie nodded, having followed holovid stories about the old education system. She tried to imagine herself faced with years of boring rote schoolwork before she could become active within the scientific community. She couldn't imagine. Already, she had done several years of fossil digs, and had three papers written, something virtually unheard of back then for a person her age. She could see why people dropped out in that rigid education system, something that didn't happen today, for it constantly adjusted to a child's needs. With interactive teaching methods developed in the late twentieth century, beginning with the then underutilized Logo system, most children didn't encounter any problems with learning and becoming involved with the community.

Wind shuffled the pine branches. The birds had left, and Debbie's memories of their songs left the forest feeling empty. She heard a dog barking in the distance behind them, probably the Labrador they had seen earlier. Somewhere, children screamed gleefully.

Rebecca looked back at the old Berkeley Hills image. "We hike where those houses and roads are. What happened to everything?"

"They were abandoned when the Oakland-Berkeley arcoplex was built," said Mom. "Most of the houses

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were razed, and the rest have disintegrated over the centuries."

Rebecca continued studying the image, wearing a familiar frown. "Everything changes, doesn't it? One day, we won't be living in arcologies. Not even a city lasts forever."

"You shouldn't worry," said Debbie. "I'm sure we'll be living in better places when the arcologies are abandoned."

Rebecca looked at Debbie, her frown lessened. "Yeah, I guess—"

Debbie heard a deep moan issue from below her feet. Before she could say a word, she was thrown into the air, along with her mother, sister and all the loose debris on the forest floor.

Debbie landed on her backside just as old branches, pine cones and stones clattered back onto the soil. Dust lifted high. The ground shuddered underneath her, bouncing her across the trail towards a berm that was becoming covered in growing cracks. Trees swished wildly back and forth, wantonly tossing a rain of branches and fresh cones. Frightened, she turned towards Mom and cried, "What's happening?" even though she knew.

"Earthquake," said Mom, watching the gyrating woods with wide-open eyes. "The trees could break! Get out! Now!"

Mom grabbed Debbie by the hand and hauled her up at the same time as her sister. The ground moved in unpredictable directions under Debbie's feet, and she found standing difficult. She grew sick to her stomach. Large cracks incised the trail.

Mom grabbed Debbie's shoulder and pushed her towards the open trail—it seemed impossibly far away, down a curving tunnel of shuddering earth and clashing, snapping trees. Rebecca, looking frightened, staggered alongside. Debbie heard a loud crash as something fell in the tree-filled canyon below. A continuous rumble seemed to permeate the air. She could barely hear other people yelling ahead of them, far down the trail.

Feeling the comforting touch of her Mom, Debbie leaped over freshly dropped branches. Rebecca jumped with her. Snap! A heavy limb smacked into Debbie's arm, and sent a searing pain through her shoulder. She gasped.

A tremendous report sounded above, so sharp and loud that it had to be something much more massive than a pine tree. Debbie's ears rang. A growing clattering sound echoed through the dancing wood. She recalled the exposures she'd seen. A rockslide?

Mom yelled, "Run!" *and gave Debbie's wounded shoulder a hard shove that sent her racing uncontrollably forward.*

Debbie gasped from renewed pain in her shoulder and stumbled over the growing carpet of limbs, finally to clear the forest. She squinted against the bright sunshine. Rebecca tripped and rolled alongside. The uphill clattering sound became a throbbing roar intermingled with the snapping of trees, sounds that drowned out all others and left Debbie feeling deafened. A blast of dust-filled air blinded her. Rocks washed past her legs, hitting her calves, making her wince and fall.

Coughing, she momentarily lay on the sharp, painful debris, unable to move. In the distance, the Oakland-Berkeley arcoplex moaned on top of a dynamic suspension system that was designed to absorb the heaviest earthquake shaking. The arcology seemed undamaged.

The shaking stopped almost as abruptly as it began, leaving an appalling silence. Debbie still felt brief twitches and jolts underneath her, as if the ground hadn't completely decided on being a solid thing. Her heart

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jumped each time the ground shifted.

With a single hand, she rubbed the grit from her eyes. Mom? Rebecca?

She bolted upright, and winced as pain shot through her shoulder and legs. Through the dust, she saw two people running towards her from the open trail. They leaped over mounds of soil and rock that had fallen from all over the hillside. Ahead of them, part of the trail's broad berm had slid away, leaving a huge gash in the woods below. Trees that survived the earthquake were out of plumb, giving the remaining forest a disconcerting feel.

She turned and spotted Rebecca sitting on the ground, rubbing her eyes with her hands in an effort to remove grit from them.

Where's Mom?

She saw no one else. Just a deep pile of rocks and broken pines covering the trail. If she and Rebecca had been a second later . . .

"Mom!" called Debbie, hoping Mom would respond, but also certain that no one could have survived being buried under so much heavy rock.

Silence.

Feeling an urge to run to the slide and start digging, she tried to stand, but her legs hurt too much.

"No-no-no!" suddenly wailed Rebecca. "Mom can't be . . . she d-didn't live l-long enough . . . Mom! Can you hear me? Mom?"

A small cascade of pebbles clattered down the rockslide, uncannily loud in the eerie quiet.

Rebecca stood up and screamed, "MOM-M-M!" *Her despairing call echoed across the broken, unfamiliar hillside, adding a strange sense of sorrow to the haphazardly listing trees.*

"Josh, you won't believe it!" Rebecca nearly yelled at the DFC's hailing system. Apparently Josh thought holograms were too intrusive or something and didn't have his displayed.

Sitting in the seat next to her, Debbie held her hands over her ears to ward off Rebecca's raised voice.

In her excitement over the bloom, Rebecca had refused to use Debbie's wristcom from the treetop, and quickly jumared back into the craft. She didn't want to waste any time getting to the field station, and called Josh immediately after she had Opie moving toward GSFES.

"What's that?" His voice sounded a bit muffled. He was probably eating something.

"The megatrees are blooming!"

"You're kidding, right?"

"No way!"

Josh coughed. Debbie figured he choked on his food. Regaining his composure, he said, "W-where are you?"

"Heading back from the Giant. I have Opie."

"Great. I want to have a look topside!" Josh sounded as excited as Rebecca.

"I've got one sample with me." Rebecca glanced at the twig in Debbie's hands.

"Looking forward to it. See you when you get here. I need to prepare."

"OK." She blew him a loud kiss.

Debbie heard him blow one back to her. She couldn't help a smile.

Rebecca looked at Debbie. "You really came at a good time."

I'm not so sure, Debbie thought, as she set the branch in her lap. She pulled her gloves off one at a time and placed them on the seat next to her. She picked up the branch, feeling its rough bark under her bare fingers, debating whether or not to bring up her observation about the needles. The yellowing had become more pronounced. *Why didn't Rebecca see it?*

With the blooming megatrees, she didn't know when she'd get another time to talk to Rebecca alone. Holding out the branch, she said, "Did you notice the needles?"

Rebecca grabbed the specimen and

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studied it. "They're yellowing. It's because the branch was picked. It has happened before when we've taken samples."

"No, Rebecca," said Debbie with a serious tone, "all the needles on the Giant were beginning to yellow before we left."

"Maybe it's an autumn kind of thing. Maybe they shed their leaves when they bloom."

Debbie looked into her eyes. "Maybe not."

"What are you saying?"

"The megatrees could be dying."

Rebecca looked away, gazing out the windshield at a forest almost fiery with the brilliant yellow of its changing needles and spherical blossoms. "I don't believe that. Megatrees don't die."

"Maybe they do. And maybe we're seeing that right now."

Rebecca banged her fists into the chair's arms. "Why can't you just leave me alone?"

Shocked, Debbie paused with her mouth open. "I'm just trying—"

"Did it ever occur to you that I left Earth to get you off my back?"

"Wha—"

"You're always watching me. Trying to keep me safe. A little of that's OK, but it especially got bad when Mom died!" Her eyes glittered with tears.

"I was trying to keep you happy!"

Rebecca gasped. "You only succeeded in stifling me!"

Feeling insulted, Debbie said, "I did what I thought was right! I gave up so much for you!"

"Well, maybe you shouldn't have."

Debbie paused. *Was it true?* Feeling tears of her own building, she stared at her knees.

"Down!" said Rebecca.

The DFC slowed and dropped.

"What are you doing?" asked Debbie, her voice meek with guilt.

"I'm going for a hike. Tell Josh I'll see him in a bit." She unbuckled her straps and stood up even before the craft landed. "Don't follow me, *OK?* I want to be alone."

Regretting bringing up the yellow needles, Debbie nodded and looked into the darkness outside.

A gentle tapping on the windshield caused Debbie to look up. Illuminated by the interior light, long skinny things slithered down the windshield, many yellow, some brown. Megatree needles.

Debbie had not bothered going to the field station since Rebecca had run off. She settled for quietly sitting in the parked craft and contemplating what Rebecca had said. *Have I really become so overprotective?* she thought. *Am I wrong in being here?*

Rebecca seemed so grown now. Independent.

The more she thought about it, the more Rebecca's words seemed true.

She looked at the bracelet in her hand, studying the tiny jewels she had carefully placed in it six years ago—eighteen years on Earth. Debbie had found the bracelet in the aisle after Rebecca had left. She wondered if the gift had been dropped accidentally.

"Message from Josh," said Opie.

Oh, furgle, thought Debbie. She'd lost all sense of time. "I'll take it."

"Where's Rebecca?" said Josh.

"Uh, she decided to go on a hike."

"Who are you?"

"I'm Debbie, her sister."

Gasp. "I thought you were at Earth?"

"I'm visiting."

After a pause, Josh said, "This day is just full of surprises. Did she say why she wanted go for a hike right when all the trees are blooming?"

"Uh," she hesitated, debating whether or not to tell the truth, and finally said, "we had a little argument."

Josh paused again. "I don't know what's up with you two, but could you please get her back? I'd like her help. This megatree bloom is probably a once in a lifetime situation."

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"Um . . ." *Should I bother Rebecca again?* Debbie thought.

With so many needles falling, it wouldn't be very long before Rebecca concluded the trees were dying. Death was the only thing that made sense. Sacrificing all that growth energy and expecting to survive just didn't seem to work. No plant she knew of on Earth did that, save deciduous trees, and they had an excuse—Verità's seasons were minimal. Plenty of Earth's plants died after blooming. The megatrees seemed to be annuals on a grand scale, or more like a forest of bamboo which died off during a single flowering after decades of growth. But annuals were a response to Earth's seasons, and even bamboo shared that genetic heritage. What was triggering the megatrees?

Debbie looked up into the darkness. *Is it the supernova?* A supernova certainly had a strong ultraviolet flux, and that could kill trees. But wouldn't the ultraviolet light kill the megatrees before they could bloom? She didn't know, but the supernova was the best idea she had.

Debbie feared what Rebecca would do when the same realization made her come face to face with her own mortality.

Debbie finally said, "OK."

"Great. I've called in Wombat for backup, and will be heading topside as soon as the craft arrives. Please have Rebecca call me as soon as you find her." Josh signed off.

Looks like I'm ruining everyone's day, Debbie thought, feeling renewed guilt. *Well, I'm not going to abandon Rebecca just yet. But this will be the last time I interfere.*

"Opie, do you know where Rebecca is?"

"She did not take her wristcom, so I don't have an exact position. However, judging by the direction in which she ran, and her habits, I'd say she went to the Amphitheater. At a jogging pace, she could have reached it by now."

"Take me there."

The DFC's engines whined to life and they lifted off.

The entire megatree forest had turned brilliant dandelion yellow, and Debbie had a hard time believing that it wasn't just a springtime meadow she was looking at. A light mist coated the windshield, yet the supernova still shone through the dense clouds, a diffuse point of light sinking toward the west.

What else was happening as the trees shed their needles and seeds? Were other organisms waiting to take advantage? And if the supernova was triggering the megatree's death, what did that mean for her and Rebecca? Surely they'd've been warned if the ultraviolet flux was dangerous for humans. However, striking biochemical changes were probably taking place in the trees—could any of them be dangerous? Not likely, due to differences in biological heritage, but maybe, just maybe . . .

After she found Rebecca, she'd get out of the Grand Stand quick—hopefully the Humpback Ridge paleontology site didn't have any megatrees.

"I've located Rebecca on multispectral sensors," said Opie. "She's sitting near the east wall of the Amphitheater."

"OK. Land as close as you can."

The rotors changed pitch, and the DFC sank into the woods. Enough needles had fallen to allow some light to pass through the canopy, giving the Amphitheater's gigantic walls a ghostly glow. Seeing herself encircled by a tree felt strange to her. It reminded her of the time she walked inside the base of a living redwood that had been hollowed by a long-ago fire—but the redwood's cavity, for all its size, still felt cramped. The Amphitheater had more space than the largest stadium she'd been in.

The craft touched down softly. Her safety belts automatically pulled away. Falling needles stuck to the windshield, being held in place by waterdrops.

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Debbie stood up, pocketed the bracelet and jogged to the exit. Opie opened the door and she ran outside, stepping into a springy soft layer of freshly fallen megatree leaves. Small hard things fell among the dropping foliage. She guessed they were seeds.

Rebecca stood from a sitting position. A cascade of needles dropped from her clothes. "I told you to leave me alone!"

"I couldn't leave you alone," said Debbie, unable to stop herself. "That letter you wrote before leaving—you sounded so depressed."

"I wrote that months ago! I've gotten much better since I moved here. On my own!" Sounding exasperated, she added, "I'm no longer the little Rebecca you used to protect. I can take care of myself."

Debbie froze. This was not how she wanted things to go. *Tell Rebecca about Josh's request,* she sternly told herself, *and talk about family stuff later.* "I know, Rebecca, I just wan—"

A tremendous snap sounded from above, so loud that Debbie's ears rang. Light filled the Amphitheater, starkly revealing the gargantuan cliff of ragged bark that surrounded her. She suddenly felt tiny, and looked up. One of the Giant's limbs had broken off. Shedding a fluttering cloud of twigs, the severed bough fell straight toward her, peeling a long cord of bark from the tree's side as it slowly gained speed. A growing roar overpowered the ringing in her ears as thousands of metric tons of wood ripped through Verità's thick atmosphere. The branch seemed like a hand reaching down to crush her. And Rebecca.

Rebecca stared upward, open-mouthed.

A whoosh sounded behind Debbie: Opie kicked his fans on. With surprising speed, he flew over her, tilted, and sent the blades into a screaming spin. The fanwash threw Debbie back, causing her to collide with one of the Giant's roots. She winced as her shoulder livened with pain. Rebecca tumbled next to her.

The heavy limb clawed Opie out of the air and hit the ground. Verità shuddered from the impact, giving Debbie disturbing visions of Mom's body being extracted from the broken rock after the long-ago earthquake. Opie disintegrated under the heavy branch, his fan blades turning into delicate puffs of string as they separated from their housing. His flying pieces faded behind a billowing wall of needles and twigs. In this case, twig was relative, and, as a heavy gust of leaf-filled wind slammed into her, limbs the size of healthy deciduous trees hailed down, bouncing off The Giant's heavy trunk, spearing the ground and shattering into hundreds of flying splinters.

A jagged log skipped off a root and fractured as it collided with her shin. Stars lanced across her vision. Needles, cones, and tiny round seeds rained down, covering her body and jabbing her eyes. Gasping from the pain in her leg, she drew some of the needles into her mouth. They tasted bitingly acidic, and she grew sick to her stomach. She spit the leaves out.

The Amphitheater fell silent.

Holding her hurt leg, she waited for the pain to subside. Drops of frigid rain sifting through the gap in the canopy tapped her cheek and hands.

"Opie! Opie!" Shedding tears, Rebecca ran into the field of shattered wood, leaping over debris toward the sickly remains of the DFC. She dug through the wreckage, apparently trying to get inside.

The ground vibrated again. Shortly after, Debbie heard a loud crash. She looked into the woods, trying to see where the noise came from, but could find nothing in the darkness. Another report sounded, one very distant.

What's happening? Remembering how the log had busted when it collided with her shin, she reached out and picked up a branch. It easily broke

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apart between her fingers. She looked up and saw the Giant's limbs swaying to a growing wind. Pieces broke from the gyrating branches as she watched, falling in a growing cascade like shards from a shattered skylight.

Debbie's heart jumped. She leaped up and staggered toward Rebecca as quickly as her injured leg would allow, glad for Verità's light gravity.

While limping, she pulled up her wristcom and transmitted, "I need a DFC right now! Emergency."

"There are many distress calls in the Grand Stand," the cyberadministrator reported. "All DFCs are active. The closest to you is Wallaby. The soonest Wallaby can arrive is fifteen minutes."

Will the Amphitheater hold together for that long? she thought as she lowered her arm. She didn't think so, and hobbled faster.

Holding pieces of Opie, Rebecca ignored Debbie's approach.

"Rebecca, we should go! The trees are getting brittle as they die. We've got to find a clearing or something!"

Rebecca stared at the falling needles and seeds. "You were right, Debbie. Nothing lives forever. Not even a machine, or a megatree." She sounded despairing. "Maybe I don't want to live anymore, either." She looked Debbie in the eye. "Leave me be."

Debbie stepped closer to Rebecca, shocked by the sudden change of attitude. "Our lives are worth living, no matter how short."

"I don't think so. Not anymore."

She stood next to her sister, wincing from the pain in her leg. "There are other ways to achieve immortality than living forever."

"Like what?"

Another snap erupted from the Giant. A cluster of sequoia-sized limbs peeled off the west end of the Amphitheater and slammed into the ground, launching a vast pall of debris. Tree parts rained down around them. The fuzzy supernova shone through the new gap.

"Come on, Rebecca," she urged, "where's the closest clearing?"

Rebecca shrugged and stared at the ground. Her hair was full of dead needles.

I've got to get her mind on something else. But what? She looked at the sky, and the brilliant star gave her an idea. "How frequently do supernovas occur?"

Frowning, Rebecca glanced at her.

"You went through school. You know the answer."

Rebecca grumbled, "About once in a hundred years within the galactic disk."

Several crashes sounded in succession. Time was running out. "OK," Debbie said, unable to control the urgency in her voice. "How often would a supernova occur close enough to Rubino to shine as brightly as that one?" With a shaking arm, she pointed up at the brilliant light.

Rebecca stared at the star. "I can't answer that."

"Think Rebecca. Maybe the answer's right before you."

Rebecca looked around at the messy collection of shattered logs and broken DFC. "Are you saying that the last bright supernova was three million years ago? That it takes the light of a supernova to cause the trees to bloom?"

"Doesn't it make sense?"

Rebecca looked up at the crumbling megatree. Her expression went from despair to wonder, and her mouth dropped open. "How could such a thing evolve?"

"Maybe we'll never know. But maybe we will." She grabbed Rebecca's arm and pulled her up. "Think about it!"

Towing Rebecca along by the hand, Debbie staggered toward the Amphitheater's tall and narrow exit. She didn't know where a clearing was, but she couldn't imagine anything worse than being in the Amphitheater, where they were surrounded by weakening limbs on all sides.

Getting through that thin gap will be dangerous. She was surprised Opie

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could fit through, it looked so narrow. Maybe, then, the gap was the safest spot. A falling limb might not be able to drop through. Certainly not the biggest ones, but a branch the width of Opie was no small thing.

"Move!" said Debbie as much to herself as Rebecca. She forced her hurt leg into a faster gait.

Silent, and looking grim, Rebecca followed.

A small branch hit Debbie's head, busting into hundreds of fluttering pieces around her. A loud report from the far end of the Amphitheater caused her to jump. Shoving aside her pain, she took large distance eating leaps in the low gravity, forcing Rebecca to do the same. The Giant's massive walls closed in on both sides. She heard creaks and pops as titanic limbs shuddered in a steady wind a hundred meters above. Near the ground, needles gently sifted down in calm air.

"I've got it!" said Rebecca. She almost sounded excited.

"What?"

"Yesterday, Josh told me," she said between pants, "that the supernova had become almost as bright," pant, "as our sun."

"Yes," Debbie encouraged. They were nearing the gap. Wood crackled under her feet. Cool raindrops spattered her face.

"I bet Verità used to get more light somehow." Rebecca tightened her grip on Debbie's hand. "Probably periodically." She took a couple of breaths. "Maybe Capire's orbit was more eccentric in the past . . . and every year it came close enough to Rubino to double the amount of light." Breath, breath. "Maybe the plants need that extra energy to . . . to make seeds."

"Nice ideas." Between her own labored breathing, Debbie asked, "What happened to Capire's orbit?" A loud rushing sounded from above. The wind had gotten stronger. She heard several cracks, and a moan.

"Something must have evened it out, maybe the close pass," gasp, "of another star. Now Verità does not get enough light for the trees to bloom." After a few breaths, Rebecca added, "Save during a close supernova."

"So the trees have to wait millions of years to flower. How did they evolve that ability?"

"Preadaptation?" Rebecca's voice sounded deep and emotionless from her exhaustion. "Maybe Josh is right about their long maturation time . . . and the megatrees had to evolve strong resistance to disease and pests to survive . . . just like Earth's sequoias." After a couple gasps, she continued, "Then maybe the processes that kill them can't happen without the extra light. Trapped into living millions of years by a simple orbital shift!"

Two deafening bangs thundered overhead. Debbie yelled, "Good idea! Now, prove it!" Motivated by a growing hurricane noise, she sprinted toward the Amphitheater's exit, yanking Rebecca along. With the sound of a crumbling mountain, the branches crashed behind. A strong gust of wind blew them through the gap among a blizzard of flying needles and seeds.

Debbie rubbed grit from her eyes, and looked up from her prone position. Yet another titanic branch landed—just in front of her. It faded into its own pall of flying debris as it impacted lengthwise, and the noise hurt her ears. She ducked her head as fragments landed around her.

She turned to Rebecca, "So, are there any clearings?"

Rebecca shook her head grimly. "Nothing close by."

Trying to figure out where to run, she stared at the mountain of freshly shattered wood in front of her. *Would another branch land in the same spot?*

She glanced above, and eyed the ragged opening the fallen limb had made in the canopy. *Probably not.* She

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frowned. *We should have stayed with Opie and the first fallen bran*—she stopped her self-recrimination. Time enough for regrets later. If they made it.

"Rebecca, climb into the wood!" Debbie stood and ran. She heard Rebecca running behind her.

Several limbs landed together and violently shuddered the earth. Debbie staggered, and flailed her arms to keep balance. A strong gust of wind lifted a chaotic fog of needles and twigs, one that grew worse as other branches crashed in a massive cascade and made their own violent blasts of air.

She reached the meters-high wood pile and climbed for the center. Rebecca appeared alongside, furiously gripping cracked wood and shredded bark as she climbed. Woodsy debris clattered around them like an intense rain, and Debbie squinted her eyes against the painful precipitation.

Debbie found a narrow space under several impact-split logs and crawled in, grateful for the shield against the hail of megatree pieces. Rebecca followed.

The forest filled with the increasing racket of collapsing limbs.

The noise of the falling branches faded. Debbie coughed up more needles and spat them out. She sat up and shrugged off a thin blanket of megatree fragments that had wafted through the opening of their natural shelter.

Debbie looked to the side and saw Rebecca sitting on her knees, still half buried in needles, breaking twigs in her hands, and letting the pieces trickle from her palm.

Debbie peered up and confirmed that no branches remained on the megatrees—they littered the forest floor, a deep carpet of woodsy debris, leaving massive trunks broken and barren. The empty boles reminded her of the Grand Canyon's desert cliffs. Bits and pieces still tumbled down the megatree's sides, mostly sheets of bark, but she got the sense that not just the branches had become brittle. Entire trees had.

Her wristcom chimed and reported, "Wallaby."

"What is it?"

"I've been occupied rescuing a group of kids on a field trip at Million Year Creek. Will arrive ASAP."

"We're OK," Debbie reported. "Get back to us when others more in need have been taken care of."

"Understood."

Debbie crawled over to Rebecca. "Sounds like we'll be waiting awhile."

Rebecca nodded slowly, still staring at the dead twigs in her hands. "You know, I'm beginning to think that some of the megatrees born of the last supernova probably did die early on."

Curious, Debbie asked, "Why do you think that?"

"Look at how easily they fall to pieces when they die. There'll be no evidence of these trees in a few centuries. If a megatree died a million years ago, or a thousand, we'd never know. I was so wrong in thinking that they all lived forev—ev—"

Rebecca started crying, heavy sobs that marked the release of long pent-up emotion.

For a brief moment, Debbie saw in Rebecca that little sister of long ago, the girl who always ran up to her in tears from her childhood hurts, seeking comfort. She wrapped an arm around Rebecca. "It's OK. You wanted to believe."

Rebecca turned her head and looked into Debbie's eyes. Her face was red and puffy. "Why did Mom have to die in that earthquake?"

Debbie found the question difficult to answer—she had never quite answered it for herself, though she accepted the fact that Mom was gone. She had some thoughts that helped her towards acceptance, and decided to give Rebecca those feelings on Mom's death. "To save us, I guess. And give us a chance to have things that she already had."

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Rebecca nodded slowly, lost in thought. Tears made sinuous trails in the dirt on her face. "I-I miss her so much."

"Yes," said Debbie with a soothing voice. "I do too. But you shouldn't let it dominate your life."

"Why do I have to be so afraid of dying? Everyone else doesn't seem to be bothered."

"Everyone's afraid of death. You aren't alone in that."

"Yeah, I know, but it doesn't help."

"You've got to try not dwelling on it so much. It's a part of your life, but not the only part."

Rebecca dabbed tears from her face with her shirt bottom. "It's so hard. I tried it by getting involved with the megatree study, and . . ." She let the obvious words trail off.

Debbie nodded. "I think with the megatrees you were on the right track. But you were still hiding from your fear, and Mom's death, by concentrating on their longevity. Maybe you should examine what the entire megatree ecology is about. You've witnessed it now."

Taking long, calming breaths, Rebecca looked at the dead trees. She studied the trunks for a moment, moving her eyes in slow sweeps, turning her head. She blinked. "What happened today is similar to what Mom did for us, isn't it? The forest floor was too dark for anything to grow. The trees died to give their seeds a chance to live."

Debbie smiled. She would have never thought of the connection. "Yes, Rebecca. It certainly seems that way." She reached into her pocket and pulled out Rebecca's bracelet. "You dropped this." She held it out in the palm of her hand.

Rebecca gently picked up the old birthday gift. She studied it a moment. Giving Debbie a small grin, she put it on. Rebecca crossed her legs and relaxed.

Bright light painted the shattered forest with a silver sheen. Debbie looked up and saw the supernova shining through a sharp break in the clouds. The illumination made the landscape seem cheerful, almost peaceful. A place finally at rest after millions of years. She wondered if the faint warmth touching her face was from the supernova. Debbie scooted close to Rebecca, and, listening to the distant clatter of falling megatree pieces, awaited the incoming DFC.

Debbie, alone in her small room at the Humpback Ridge paleontology station, finished stuffing clothing into her backpack—she was still amazed that it had survived the destruction of Opie. She couldn't help feeling a bit sad, not just because of Opie, but also because she was leaving, and events of the past Verità year kept surfacing.

She spent some of her free time between digs and microseismic surveys with her sister at GSFES. The facility always seemed empty, for most people who lived and worked there had left for various projects—new studies aimed at trying to figure out exactly what went on when the largest trees in explored space had died.

How did the trees initially survive the supernova's ultraviolet flux so that they could bloom? Sure, they did die, but that was weeks after Sundiver and Splash lit up the heavens. Verità's thick atmosphere certainly helped, but was it also because plants produce ozone? And what process made the trees brittle? Josh though it might be due to a kind of symbiotic bacteria—some of his colleagues found the wood to be filled with the little organisms, consuming the material at a rapid rate. He thought the trees might keep the bacteria dormant—or at least controlled—biochemically until the right amount of light arrived. Then the megatrees would let the bacteria proliferate, causing the rapid deconstruction of their giant trunks so that the seedlings would get enough light to grow. And exactly how had the trees evolved their depen-

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dence on supernovas? Many of the researchers liked Rebecca's basic idea, but some had solutions of their own. One suggested that the trees might simply need the light to stimulate flowering, for they had a lot of stored energy in their root systems—surely enough to produce seeds without the aid of a supernova.

Other things had happened aside from excitement over the megatrees. She had her own paleontology work. It was enjoyable, but there wasn't much to study. A few fossils of Verità's minimally diverse assemblage of plants and animals. After the megatrees bloomed, and Rebecca's thoughts on their evolution spread throughout Verità's scientists, excitement had grown over the new horizon Pierre had discovered. Pierre suggested that the sudden decline in diversity seen in that stratum may have been the time Verità's orbit shifted. They dated it to about three-hundred-and-seventy million years ago. He now concentrated just about all his resources on that particular horizon.

But even the new study wasn't enough to keep Debbie interested. The highest diversity on Verità was still nothing compared to the Earth. She wanted more variety, and had studied the charters of some other colony worlds. The fast seasons of planet Bode, in the Barnard's Star system, were interesting, as was the diverse and complex ecology that had evolved under the stress, and she decided to go there. The *Santa Maria* was destined to go back to Earth, and from there she could hop on the next ship to Bode.

About the same time that she made the decision, a message from Dad had arrived—a message sent over eleven years ago.

Rebecca listened to Dad's hello with her. Rebecca got tearsy, and immediately sent a reply, letting him know she was doing well on Verità, and openly wishing light were a faster thing. Debbie sent her own message, telling him she missed him much, and that she was sorry because she decided not to stay at Earth. She'd have a few weeks to visit before *Spring's Adagio* flew to Barnard's Star, assuming it would be on schedule more than a decade in the future. Maybe she'd like Bode enough to stay, or maybe she'd want to move on to another planet—to see what the Universe had to offer.

She felt tears welling up. She already missed Dad, even before she had her chance to say goodbye.

A mellow chime echoed through her empty flat, and then a casual voice said, "Rebecca."

"OK."

Debbie watched a holographic representation of her sister appear in the middle of the room. Rebecca looked excited. "The megatrees are sprouting! You must see them before you go!"

Seeing her sister so enthusiastic made her feel good, despite the fact that she was leaving Verità soon. "I'm just about packed. I'll be right over."

Rebecca tugged Debbie out of the DFC. Wood-chip alluvial fans draped the bases of slowly shrinking megatree trunks. Heaps of disintegrating wood surrounded the Grand Stand Field Ecology Station—like unwanted snow, it had been shoved off the landing field and research structure. One of the buildings had been crushed by a fallen branch; fortunately no one had been hurt. Repairbots had not been called yet, for the residents liked the unexpected nature of the wreckage. Maybe it'd never be fixed. There was talk of bringing in a replacement hoverstation next to the wrecked one.

"Over here! There's a whole bunch of them!" said Rebecca as she tugged Debbie by the hand.

The noontime sun almost felt warm. Debbie looked up. She could barely make out the point of light that marked the supernova, hanging low in the sky.

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It had dimmed over the Capirean year, and taken on a slight reddish cast. At night, the brilliant star still rivaled her best memories of Mars. In fact, it still outshone Venus, though the color was wrong.

Debbie spotted Josh as he idly scanned the sky from the GSFES porch. Apparently he decided to leave her alone with Rebecca, but she could tell that he also was excited about the new trees. He was a lanky fellow, with long black hair and bushy eyebrows. Very quiet, shy. He didn't speak much during her visits to the field station. But he seemed nice.

Rebecca stopped at a small patch of green and kneeled. "Here they are! Aren't they beautiful?"

Debbie crouched next to her sister, and studied the seedling's tiny star of needle leaves. They reminded her of the sprouting pines that she often saw during spring in the Berkeley Hills. "Yes, Rebecca, the new trees are beautiful." She carefully touched one, feeling the tough, yet flexible leaves tickle her finger.

"Now we get to study how they grow," said Rebecca. "See how this ecosystem works. Other plants are invading. We've found two new species." She looked around. "Ah, here's one." She pointed to a squat plant that resembled a small yucca.

Debbie nodded. "Obviously taking advantage of the new light on the forest floor."

"Yes, but how did it get here? There are no large animals to carry its seed, which is about the size of an acorn." She reached down and picked up two brown half shells, and handed them to Debbie. "Here's the broken husk. Did its seed last three million years, waiting for a chance to grow?"

As she studied the shell, Debbie wondered if the seed had been carried on a person, or a DFC. She looked around, and spotted other plants of the same species scattered as far as she could see. She decided that there were too many for her explanation to work. *Maybe,* she thought, *the answer to physical immortality will be found in Verità's plants.* "Sounds like you've got plenty to keep you busy for a long time."

"Yes!" Rebecca's eyes gleamed at the prospect.

Seeing her sister so cheerful made Debbie feel warm inside.

Her wristcom chimed.

"Yes?"

"Final call for passengers to the *Santa Maria.* The shuttle is ready for liftoff."

Debbie took one last look at the megatree seedlings and stood. She brushed a few dead needles from her knees. "Guess I need to go."

Rebecca stood. "Wait one second. I have something to give you." She ran into the closest GSFES dome. After a few seconds, she ran back out, carrying one of her smaller paintings, one about a meter wide.

She offered it to Debbie. "Here. I finished it just last week. I think it's my best one."

Debbie smiled and looked at the gift. The painting showed an aerial view of the megatrees bathed in the supernova's cool light, with the rugged peaks of the Sierra del Fuego in the distance. The trees seemed to be reaching for the supernova's illumination, suggesting they desired the bloom that it would trigger. Even with that one bit of tension, there was an air of peace about the painting. Maybe it was from the patches of mist, or the lazy clouds, or the cool, dark sky, or possibly the way the tree trunks sat, squat and solid. An ancient forest preparing to rest after a long, long time.

"Lovely," she said. "I'll take it with me wherever I go. Just think, I'll have the only Rebecca della Cava original on Bode."

Rebecca grinned at her. "Thank you."

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"I feel a bit guilty. I've nothing to give you."

"That's OK. You already have. You helped me when I needed you most."

Debbie leaned the painting against a crumbling log and gave her sister a strong hug.

"Why don't you stay longer?" said Rebecca during the embrace.

Debbie pulled her head back and looked at Rebecca. After giving her a smile, she said, "There's a part of me that wants to. But it's time for me to find my own life now. You know, stop worrying so much about others."

A somber smile crossed Rebecca's face. "I understand." A tear rolled down her cheek. "I love you."

"I love you, too. Now keep in touch, OK? I want to hear about the acclaim when your ideas about the megatrees are proven."

"You, too." She added, "I guess the new sprouts can't be called megatrees anymore. Just trees. Then decatrees, hectatrees, kilotrees and . . ."

Debbie laughed at the small joke. It was hard to keep the giggles from turning into sobs.

Rebecca smiled with her. A pretty grin, warm, one marking the peace that had grown inside her.

Debbie embraced her sister again, savoring the last, brief touch.

After the hug, Rebecca awkwardly rubbed a tear from her eye.

Debbie glanced at her wristcom. "I . . . I had better go."

"Take care!"

Debbie nodded, unable to speak anymore. With her vision blurred by tears, she grabbed the painting, awkwardly waved at Rebecca, turned, and walked toward the DFC. □

IN TIMES TO COME

Our next issue is our July/August double issue, offering roughly twice your usual allotment of the things you read *Analog* for. Nick Jainschigg's cover (more startling on second look than at first glance) aptly illustrate's "The Astronaut from Wyoming," a thoughtful and thought-provoking novella by Adam-Troy Castro and Jerry Oltion that could be happening as you read. Just what *do* people use as the basis for their decisions, and what does the present social climate say about our scientific future? You'll find this one both entertaining and disturbing, and both the story and the title character are likely to keep haunting you long after you've read it.

Our other fictional offerings will include stories by such writers as Amy Bechtel, Shane Tourtellotte, Laurence M. Janifer, Joseph Manzione, and H. G. Stratmann, plus the conclusion of Catherine Asaro's *The Quantum Rose*. G. David Nordley's science fact article, "Beamriders," shows you some of the real science behind the particle beam propulsion systems that have figured in several stories by him and others. And Joseph H. Delaney offers a special, hard-to-classify article that should be of special interest to any practicing or aspiring writers (which includes quite a lot of you). As some of you may know, Delaney launched an impressive writing career here in direct response to his annoyance with the errors writers made in handling the legal situations (such as courtroom dramas) that often arise in stories. Himself an attorney with many years experience, next month he offers some insider's secrets on how to do it right.

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BIOLOG Jay Kay Klein

Analog author Wolf Read is also an *Analog* artist. The wonder is how someone gets to be a double-threat contributor when it is difficult just to be good enough to be published in one field. Most *Analog* authors have accomplished this largely on their own. Artists notoriously have developed through innate ability, often precocious, coupled with self-direction. *Analog* author Fred Pohl dropped out of high school to become as erudite a scholar as one could hope to meet, but Wolf did him one better by dropping out at the end of the eighth grade. He felt the public schools were doing a miserable job, and still are.

At sixteen, he did exceptionally well on the GED, including a ninety-ninth percentile in science. Born and raised in the Seattle area, at eighteen he decided to go to Idaho State University to pursue paleontology. He studied biology and geology for four years, while working two years as a scientific illustrator for the Idaho Museum of Natural History. Another job in the university embryology lab brought encouragement in science fiction writing and illustration from the lab's director. A change of major to Fine Arts led to nearly three years of study in the ISU art department.

Wolf notes that some people think you must have a doctorate to write stories acceptable to the highly educated Dr. Schmidt. Like Fred Pohl, Wolf has no formal degrees. Since 1994 he has lived in the San Francisco area, working until recently as a research associate at the Lawrence Berkeley National Laboratory. Now he is a senior illustrator at the nearby Lawrence Hall of Science doing computer-generated science illustrations and animation for educational CD-ROMs.

Photo by Antonino Read Rojas

Wolf (A.) Read (and wife)

The foundations for the dual career path were laid in childhood when he convinced his teachers to allow him to write stories in lieu of doing copybook make-work—self-illustrated, of course. Submissions to *Analog* started in 1988, then after two years the editor began giving him writing advice. Finally, in 1996 Stan bought a "fact" article on the alien world of Epona Wolf had been creating with thirty other people. The art director asked him to do the cover illustration for the same issue's story about Epona by G. David Nordley (November 1996). Stan not only soon bought a novella, but asked him to do the cover for the issue (March 1997). Wolf had sought a cover assignment once before, several years earlier.

At ISU, Wolf's creative writing

(continued on p. 142)

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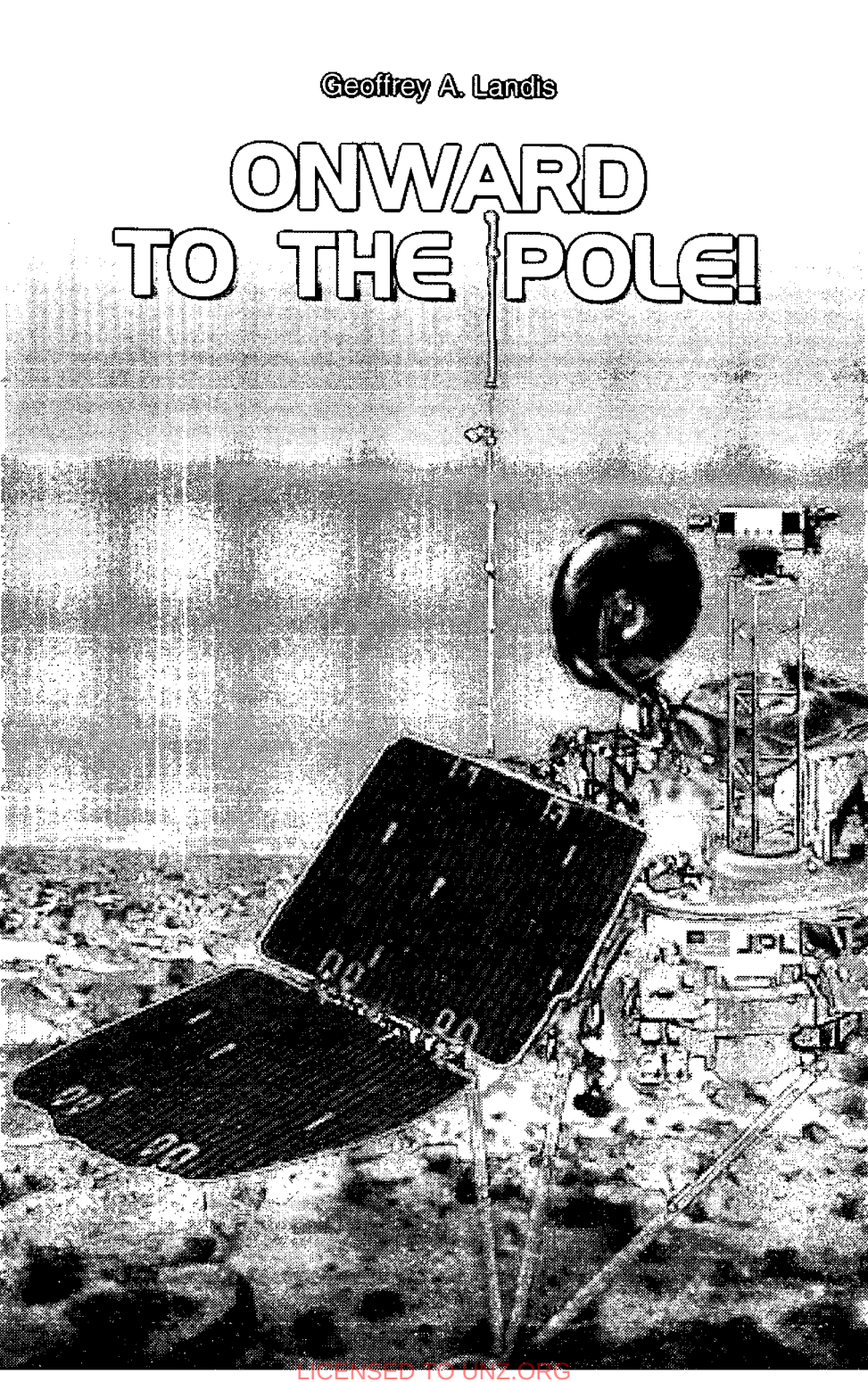
Geoffrey A. Landis

ONWARD TO THE POLE!



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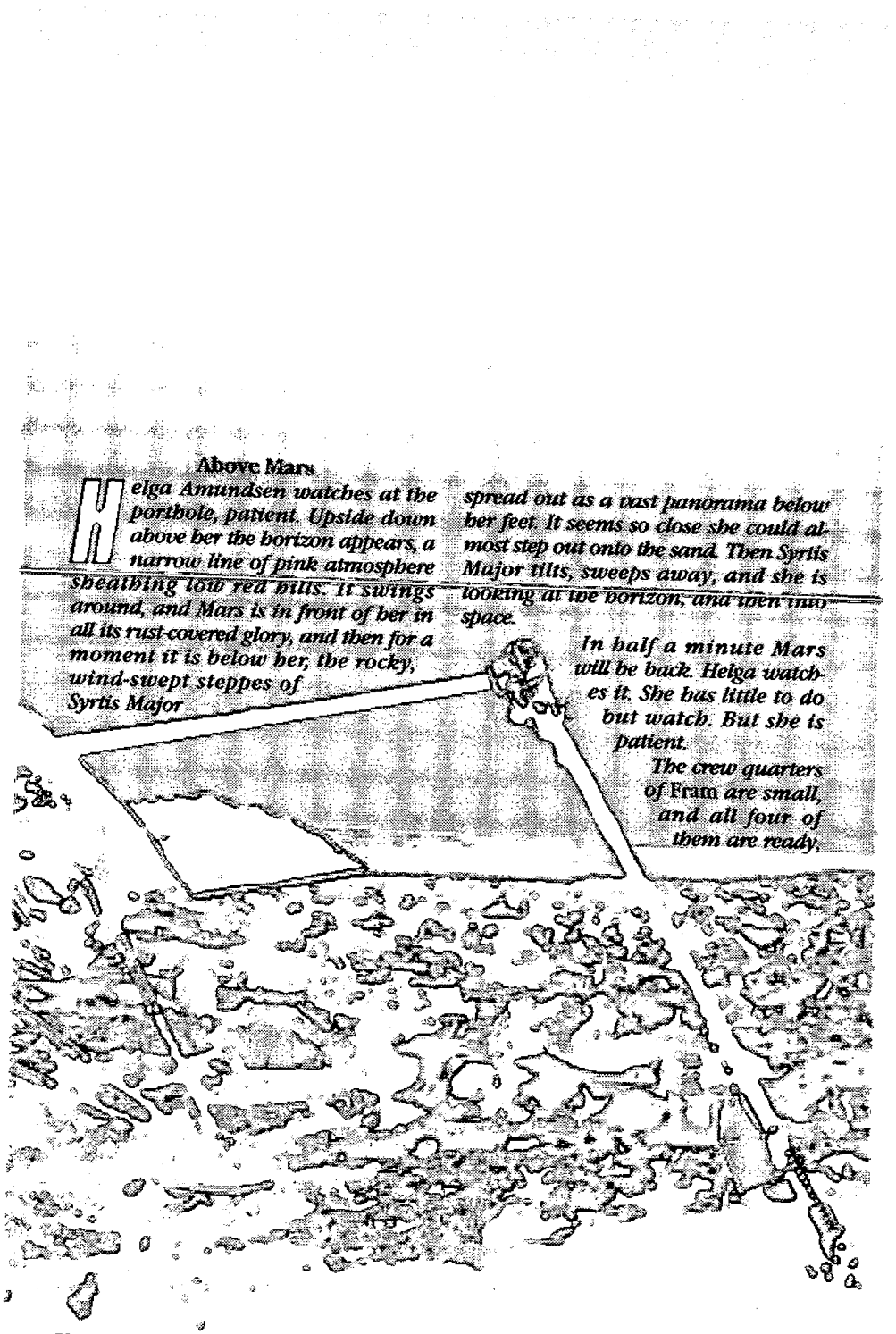
Above Mars

Helga Amundsen watches at the porthole, patient. Upside down above her the horizon appears, a narrow line of pink atmosphere sheathing low red hills. It swings around, and Mars is in front of her in all its rust-covered glory, and then for a moment it is below her, the rocky, wind-swept steppes of Syrtis Major spread out as a vast panorama below her feet. It seems so close she could almost step out onto the sand. Then Syrtis Major tilts, sweeps away, and she is looking at the horizon, and then into space.

In half a minute Mars will be back. Helga watches it. She has little to do but watch. But she is patient.

The crew quarters of Fram *are small, and all four of them are ready,*



Mars Polar Lander.
Launched January 1999, the polar explorer will land on the frost near the south pole of Mars in December. Image courtesy of NASA / Jet Propulsion Laboratory / Caltech.

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more than ready, to land. Mars, their destination, hangs tantalizingly in front of them, and after ten months they are desperate to do more than just wait in orbit.

It is their ship Fram, *and not Mars, which is spinning, of course. The ship is on one end of a five-kilometer tether, barely thicker than kite-string. The habitat module is counterweighted by the burned-out rocket engines and empty fuel tanks that gave them the impulse to make the long traverse from Earth to Mars, and spins at a lazy rate of slightly under one revolution per minute, just enough to give them the feel of full Earth gravity. Back in the previous century, NASA spaceflight physicians had worried about decalcification causing bone loss during the long zero-g trip. It had been a silly worry, easily solved. A tether provides the effect of gravity with almost no additional mass. They will be strong when they land on Mars.*

Now that they're in orbit around Mars, the centrifugal gravity modulates, increasing slightly and then decreasing as the tether rotates through the Martian gravitational field. The rate of spin varies slightly as well, speeding up approaching vertical and then slowing down as it rotates toward the horizontal. Some of the crew complain it makes them seasick. Helga, though, is comfortable: she was practically brought up on the ocean, and the lazy swell feels comfortable to her. She thinks of it as the gentle swaying of a Viking longship.

On the surface below, when they are in the right part of their orbit, through a pair of binoculars they can see the return ship, fully fueled in twilight, waiting for them. They can query its systems, run practice runs on its computers, verify its status in perfect working condition, but they have to wait.

They are waiting for sunrise.

Journey to a White Planet

There have been about ten thousand missions to Mars—in science fiction, anyway—and but, when you read those classic stories about the first human to set foot on Mars, I doubt that you have ever read one in which that historic first step is a step into snow.

And yet there are excellent arguments that the Martian poles would, in fact, be the best possible targets for a first mission to Mars. In particular, I will argue that a mission to land on the permanent ice of the north polar cap during the polar summer would be far easier than a mission to any sites on Mars at lower latitudes.

Why go to the Pole?

There are many operational advantages to a polar landing site (assuming, of course, that the landing season is picked to be during the polar summer, and not the polar winter.)

1. Constant sunlight (during polar summer). The electrical power system can be the single heaviest part of a Mars base, especially for power-hungry missions such as those where tons of rocket fuel have to be manufactured from local resources. A nuclear power plant? But nukes are heavy, too, and may not be be politically feasible.

Mars, though, has seasons, and the polar regions, like the Earth's polar regions, receive 24-hour sunlight during the summer months (24 hours and 40 minutes, if you count in Earth hours instead of Mars hours). A solar power source exposed to the 24-hours per day of polar sunshine would be an extremely lightweight, high reliability power source. The heavy, inefficient, and unreliable electrical storage system, either batteries or regenerative fuel cells, can be eliminated.

2. Simplicity of the power system. A solar array designed for the polar latitudes is also simpler than a solar array for other latitudes. At the poles, the sun never gets very high, but loiters around just above the horizon. So the system for tracking the sun requires only a simple vertical pivot. And, as an added bonus,

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the vertical array will not accumulate dust—a major problem to the lifetime of solar arrays on Mars*.

If that isn't enough, the efficiency of conversion of a photovoltaic array increases at low temperatures, and the amount of light reaching the arrays is nearly doubled by reflection from the snow—so the arrays are simple, dust-free, efficient, and get 24-hour power. What more could you want?

Touchdown

Now that sunlight has at last reached the pole, Helga and the crew of Fram *board the landing craft, cut loose from the tether, and drop through the thin atmosphere of Mars. The lifting-body craft rips through the atmosphere, shedding its orbital velocity as a sheet of superheated plasma. Subsonic now, although still traveling at several hundred miles per hour, the landing skis are extended, and the ship throws up a plume of carbon-dioxide snow as it skids to a landing.*

The landing is perfect: not half a mile away they can see the Earth return rocket and the surface habitat waiting for them. The Earth return rocket is already fully fueled—it had landed in 2016, two years earlier, and set about filling its tanks with hydrogen and oxygen fuel made by electrolysis of the abundant ice.

As captain, Helga Amundsen has allotted to herself the historic task of planting the first footsteps on the surface of Mars. Helga is the four-times-great grandniece of the famous arctic explorer, and although she was picked because of her own arctic exploration skills, and not for the sake of her name, it is nevertheless both an honor and a burden to live up to her ancestor's fame.

She climbs down the ladder. The twilight glow of the sun, halfway over the horizon, has turned the ice a luminous pink. She puts a toe on the ice and pokes it. "It's crunchy," she says. "Seems firm enough. I'm about to step off. OK, here goes." She puts one foot firmly on the ice, then the other. It holds her. She takes a deep breath, opens her mouth to say the historic words she has memorized, and then, as the thin layer of carbon dioxide frost vaporizes under the not-perfectly-insulated soles of her boots, her feet slide out from under her on a cushion of carbon dioxide. All of Earth hears the historic words spoken after the first foot is set on Mars.

"Whooooops! Yow! Ouch!"

More Reasons to Go to the Pole

3. Abundant resources of the pole. The key to exploring the solar system is to use the resources available out there, instead of bringing everything from Earth. The most crucial of the products to be made with local resources is rocket fuel.

While many people talk about producing rocket fuel from the thin carbon dioxide atmosphere of Mars, the single most useful raw material to make rocket fuel from is water. And water is available at the north polar cap, in the form of polar ice. It is available in vast quantities, in an easily accessible form, and does not require drilling into buried permafrost layers or condensing a low mass-fraction component out of the atmosphere. Water ice can be melted and electrolyzed to make hydrogen and oxygen rocket fuel.

If you want a fuel more convenient than the very efficient but difficult-to-store cryogenic hydrogen, hydrogen electrolyzed from water can be used in Sabatier or RWGS reactors (as proposed by Robert Zubrin [2]) to form methane and higher hydrocarbons. Or, if you're only looking for oxygen, you can electrolyze the water and simply discard the hydrogen.

If in-situ resources are really the key to space exploration, why not land in

**As discussed in my article "Adventures in the Mars Business," in the July/August 1998 issue.*

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the site where the best possible resource is known to be present?

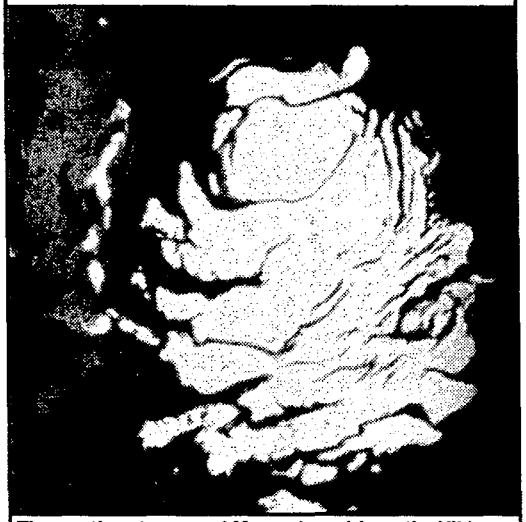
4. Constant temperature (during the polar summer). The temperature of the polar ice cap stabilizes during the summer at a point very close to the frost point of carbon dioxide, -125°C. The absence of a diurnal cycle will make the design considerably more robust, since it is thermal cycling, and not low temperature in and of itself, that puts stress on parts. And heating is a lot simpler than cooling, anyway.

5. Low temperatures. Low temperatures are desirable for liquefaction and storage of rocket propellant. Cryo-coolers are much more efficient in the lower temperatures. Less insulation will be necessary for cryogenic propellant storage, and some "soft" cryogenic propellants (such as methane) are liquid at -125°C with only mild pressurization. And electronic and life-support systems won't need the massive thermal radiators required to reject waste heat at low-latitude sites.

6. Orbital station passes overhead every orbit. A return vehicle or a return habitat module may be stored in Mars orbit. There are more opportunities for a launch to rendezvous with an orbiting vehicle if the landing site is at the pole. Furthermore, since communications to Earth will be via a relay satellite, the increased number of overhead passes increases the contact with Earth. That will make the difference between near-real-time high datarate video and frequent contact with home, and twice-daily contact. High data-rate is important to public interest and scientific participation, and immersion "virtual reality" quality images and data will require bandwidth.

7. Polar resources for long-duration traverses. The abundance of sunlight and the fact that polar ice is available for hydrogen means not just rocket fuel, but in-situ fuel for local mobility, including such vehicles such as wheeled rovers, slender-winged Mars airplanes, or rocket-powered "hoppers." In fact, if it's of interest to visit non-polar sites, the easiest way to do it would be to land on the polar cap and traverse from there.

figure 1



The south polar cap of Mars, viewed from the Viking orbiter, during southern summer on Mars. Shrunken to its minimum extent, the polar cap is only 250 miles across. Image courtesy NASA.

On the Pole

Slipping on the almost frictionless film of carbon dioxide may have damaged Helga's ego, but it presents no real difficulty. This is one of the possibilities that the crew was prepared for. Ingrid Hjorvarsson, the chief geologist and Helga's second in command, quickly comes out of the airlock, bringing with her two sets of the special snowshoes that they had made to take care of this eventuality. Well insulated and cleated, they distribute the heat much better than the standard boots. Later in the polar summer it won't be as much of a problem, as the outer layer of car-

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bon-dioxide frost sublimates away and leaves the less-slippery water ice surface behind.

Soon the nearly frictionless surface is transformed from a liability into an asset as the skis are brought out. Now the explorers can really cover territory. Helga has to repeatedly warn Ingrid and Sarah, the two geologists, not to explore too far.

The colors are a particular spectacle. The polar snow is white, the sky is red at the horizon, and directly overhead, where the dust is thin, the sky is deep blue. White snow, red horizon, blue straight overhead. It makes Helga feel patriotic: it is the colors of the Norwegian flag. And, although surrounded by a red glow, the disk of the sun is the palest possible shade of baby blue, transparent as water.

After an hour of childlike exploration, spent wandering almost aimlessly and exclaiming over the sights of the landing zone, so similar and so different from the terrestrial arctic, they go to work. The first item of business is to check out the return vehicle, and verify that it is, in fact, fully fueled and in suitable shape for their return to Earth. Engineer Olga Heyerdahl supervises this check out. She is, in fact, no relation to the famous Thor Heyerdahl of the twentieth century, but the media have nevertheless made great press over the coincidence of names, Amundsen and Heyerdahl exploring together at last.

After a full day of checking and rechecking, Olga pronounces the return vehicle in perfect shape. After a brief celebration, marked by non-alcoholic champagne, they start to unload the science equipment. The real work is about to begin.

Science At the Martian Poles

No place on Mars is uninteresting! Scientifically, we can learn tremendous amounts about Mars from anywhere we land, so it makes sense to go to the location on Mars which is easiest to get to (and to get back from). Nevertheless, the poles of Mars are of particularly great scientific interest.

The polar regions of Mars are not well understood. The maximum thickness of the ice cap is unknown, but is estimated to be between 4 and 6 kilometers. Likewise, the amount of volatiles stored in polar ices is a matter of some debate.

One of the important reasons for studying Mars is to understand the question, how is the Martian climate different from Earth? On Earth, the way we study the climate record is by looking at ice cores drilled kilometers down into the pristine polar caps of Greenland and Antarctica. Hundreds of thousands of years—possibly millions of years—of Martian climate is recorded in the ice caps; if we want to learn the climate history of Mars, we should go to the poles. From core samples of the ice, isotope ratios, atmosphere inclusions, and dust layering can be examined.

We know that Mars was once warmer and wetter than it is now; is the warmer climate episodic? How long has it been since the last period in which Mars had a climate where liquid water existed on the surface? Some scientists suggest that the obliquity, or tilt, of Mars's rotational axis to the sun changes periodically; if it does, how does the obliquity of the Mars axis affect climate? What are the long-term climate cycles, and how do they phase with variations in the eccentricity and axial tilt of Mars? What is the historical record of global dust storms, and how do they depend on the climate and the orbital parameters?

And, Mars is cold, but it once was warm: can we someday change it back?

Most importantly, we humans would like to know about our own climate, and how much of a role we are playing in altering it. What can we learn about the climate of the planet Earth—past, present, and future—from knowledge of the climate of Mars? The answers to these questions are encoded in the layers of the polar ice.

Another reason to go to the polar re-

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figure 2

High-Resolution View of North Polar Layered Deposits at 84°N viewed from orbit by the Viking spacecraft (Viking Orbiter mosaic P18459.)
Width of this picture is about 30 miles. The white layer at the top of the image is the surface of the polar ice cap. Below this, the cliff is about 1500 feet high, containing a series of layers about 150 feet thick. (Additional layering with smaller thickness is not detectable at the resolution of this image.) Figure courtesy NASA.

gions is that the poles of Mars are encircled by an area of Mars known as the polar layered terrain (figure 2). This kind of territory is unique to Mars. Layered terrains cover an area of slightly under half a million square kilometers around the north pole, and over a million square kilometers around the south pole. What is the layered terrain, when was it laid down, and what information does it encode? Thomas et al. [3] summarize the current knowledge of polar deposits and conclude: "the polar deposits remain mysterious after many years of close scrutiny." They follow this statement with a list of six major items that are unknown, ranging from composition of the layered deposits to the correlation of layer thickness with the expected climate cycles. If we are going to Mars to find landforms not present on the Earth, we will want to examine the polar terrain.

A final reason to choose a polar landing site is the search for life. A key part of the search for life is the examination of organic molecules. In general, organic molecules do not exist on the Mars surface; the Mars environment is too hostile for organics to be able to be preserved for long. There is one exception to this rule— the poles. In the polar regions, organic molecules could be preserved in a "deep freeze," protected from degradation by low sun angles, low temperatures, and deposition of protecting layers of ice.

According to Mars biologist Chris McKay [4], thermal degradation of DNA is the main reason that ancient DNA is not found on Earth: even in arctic regions, the temperature is too high. But at temperatures below roughly -70°C— that is, at Mars polar temperatures— DNA and protein molecules could be preserved for time periods as long as four billion years. Oddly enough, frigid Mars may in fact be a better place to search for signs of ancient DNA than the Earth itself. Four billion years ago Mars was a warm and wet planet, and life may very well have evolved then. If it did, we should be looking for molecular signs trapped in the polar regions. (McKay also notes that, over a time scale of only a few tens of millions of years, the ubiq-

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uitous natural radiation from rocks will accumulate to a lethal dose. Thus, if we find three-billion-year-old microbes in polar ice, they will be frozen, but dead. No need for Andromeda Strain precautions here.)

Mission Phasing

A disadvantage of a polar landing location comes from the fact that the mission has to occur during the polar summer. This reduces the number of mission opportunities, since some launch windows arrive at Mars during the wrong season. The numbers of mission opportunities is increased if missions are accepted where the surface stay is less than a full half year.

At the north pole, spring and summer last a total of 383 days, and for the south pole a total of 305 days (counting in Earth days here, not Martian sols). The duration is shorter in the southern hemisphere since perihelion occurs during southern summer.

The 383-day north-polar sojourn is slightly less than the 440-day stay time typical of a conjunction-class (minimum energy) mission. But the penalty for arriving at Mars thirty days late in the launch window, and for launching for Earth thirty days early in the launch window, is relatively slight. So the constraints are not terribly severe.

A strategy to deal with the requirement to land after the onset of sunlight is to arrive at Mars and wait in a parking orbit until the beginning of the hemispheric spring. Since the mission transit time is typically eight to eleven months, one to three months of orbiting is not unreasonable.

Table 1 shows the minimum-energy launch and arrival timelines for two typical northern-hemisphere summer mission opportunities. As can be seen, for the 2016 mission, the optimum date for arrival in Mars orbit occurs three months before sunlight reaches the north pole. Thus, the mission would be required to wait in Mars orbit for 106 days for the landing window to open, if continuous sunlight is required. Alternatively, the mission could pay a slight penalty for late departure, and shorten the time waiting in Martian orbit. Since the return to Earth occurs before the autumnal equinox, the mission can leave directly, without waiting in orbit.

For the 2018 launch opportunity, the optimum arrival at Mars occurs 75 days before sunlight reaches the pole. In this opportunity the optimum trans-Earth injection occurs slightly after the end of the polar summer, and hence the mission must either depart for Earth before the optimum date, and pay the (relatively minor) penalty in delta-V required, or else must wait in orbit for the optimum return window.

An alternative would be to land at a polar latitude somewhat less than 90 degrees. In this case, there will be some sunlight before the beginning of spring, and so a daylight landing could be done before the vernal equinox. This may reduce the continuous-sunlight advantage of the polar site, but still, during most of the mission stay, the sunlight duration will be long.

table 1

Example: North Polar missions opportunities in 2016 and 2018, comparing arrival and departure dates with the beginning and end of continuous sunlight at the polar landing site.

Launch Opportunity	Mars arrival	Mars departure
2016	**1-20-2017**	**3-14-2018**
Vernal equinox: 5-5-2017		**Autumn equinox: 5-23-2018**
Mission arrives 106 days before northern spring		*departs before end of summer*
2018	**1-17-2019**	**6-6-2020**
Vernal equinox: 3-23-2019		**Autumn equinox: 5-10-2020**
Mission arrives 75 days before northern spring		*departs 27 days after end of summer*

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An All Woman Crew to Mars?

Some of the readers might have noticed that Helga Amundsen and her loyal companions, the crew of the hypothetical Martian polar mission Fram, seem to be missing a certain element of biological diversity: where are the men?

The idea of a single-sex space mission is hardly new—after all, we Americans have sent 27 humans to the moon, all of them male, and the vast majority of the flight experience on the Russian Mir space station is with crews that were entirely male. If I had suggested that the crew of a Mars mission be entirely male, the suggestion might be considered "politically incorrect," but it would hardly have been considered impossible—after all, there have been dozens of proposals for all-male missions to Mars.

So why not an all woman crew for a Mars mission?

Women, after all, are on the average smaller than their Y-chromosome-gifted counterparts: they use less oxygen, consume less consumables, produce less carbon dioxide. They take less space.

In addition, statistics show that all-woman groups are far more likely to chose non-confontational approaches to solve interpersonal problems, and most definitely are more likely to deal with a situation without resorting to violence—which could be a big problem on a Mars journey, where the crew must live in close quarters for two to three years. For example, in America, a male is about eight times more likely to commit a violent crime than a woman. This difference is remarkably consistent across different cultures. Statistics from three dozen human communities around the world, from Iceland to Zaïre, show that with a single exception, the probability that a single-sex murder has been committed by a man instead of by a woman ranges from a low of 92 percent to 100 percent. (The exception is Denmark, where the figure is "only" 85%.)

Numerous sociological studies have shown that women, in general, are more cooperative, and less given to hierarchical social structures—all properties which may very well be highly desirable on a long-duration space mission. (For those of you who wonder if I am advocating some sort of genetic determinism, let me hasten to add that it is not at all clear whether the sociological differences between groups of men and groups of women are due to genetics, or due to the different cultural expectations and training of men compared to women.)

After all, a Mars mission is unlikely to require raw physical strength. So: would an all-women crew be the ideal personnel for a Mars mission?

Disadvantages

It would hardly be fair of me to extol the advantages of landing at the Martian pole without mentioning that, yes, there are some disadvantages as well.

The major disadvantage of a polar landing location, as discussed above, comes from the fact that the mission is constrained to occur during the polar summer. This reduces the number of mission opportunities, and puts constraints on the mission stay duration.

Other disadvantages are comparatively minor. Some of these disadvantages include:

1. Geology. Planetary geologists, in general, are (with a few exceptions) not greatly interested in studying ice; geologists like rocks. Nevertheless, it may be easier operationally to land at a polar location and then travel to a desired non-polar region than to land in the non-polar region in the first place.

2. Low temperature. I have listed the advantages of the temperature being close to constant, but it is, in fact, more than just low temperature: -125°C is downright frigid. This is a disadvantage in operating many types of equipment. Bring your parkas; it's cold!

3. High air mass. With nearly horizontal sun angles at the poles, the sunlight slants through the atmosphere along a path many times the thickness of the atmosphere. This means that the amount of dust in the path of a given ray is much higher at the poles than at subsolar latitudes. (However, despite these factors, I believe that on the balance the advantages of a polar landing site to the power system outweigh the disadvantages.)

And finally:

4. Wind. Polar wind velocities have not been directly measured, but, during the polar spring, when large amounts of frozen carbon dioxide sublimate into the atmosphere, the wind velocities at the edges of the polar caps are believed to be very high. Evidence of high wind velocities is seen in the small dust storms at the edges of the caps during the spring. The wind ve-

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locity at the center of the caps is unknown.

Since the density of the Martian atmosphere is less than 1% of the density of the Earth's atmosphere, high wind speeds do not present nearly as much of a problem on Mars as they do on Earth. Still, it would be a good idea to more fully characterize polar winds with an unmanned probe before sending the polar mission to land.

Return

After a year on Mars, the Fram *expedition has explored the polar regions from the polar cap to the layered-terrain and the polar dune-fields around it. They have even taken long geological field trips in methane-powered rovers across the Boreal Vastitas as far south as the mysterious grooved terrain of Tantalus Fossae. There certainly wasn't a shortage of places worth exploring! They would have liked to stay for years longer—except that the long polar day is drawing to an end, and their launch window has arrived.*

As they launch from Mars, the American expedition is just braking into orbit. Helga Amundsen shakes her head. Like Scott, arriving at the South pole just one month after her ancestor Roald Amundsen had planted his flag there, the American expedition is larger and more expensive than the small Scandinavian one. It has to be: they are aiming for a landing near the equator. She wonders why they ignored the obvious advantages of a polar site. The south pole of Mars is still unexplored! She only hopes that their expedition will be more successful than Scott's.

Still, Helga's mind can't help drifting to the future. When human colonies are planted on Mars, will they be nomadic, migrating from the north pole to the south, and back again, following the sunlight? And, now that footprints have been planted in the snows of Mars, what planet is next to conquer? Will she get a chance to plant her footprints into the polar snows of Mercury?

But they have work to do; the Earth-return vehicle to check out, subsystems and computers to boot up. She turns to her crew, and begins their preparation for the long journey home.

Polar Exploration Today

The era of Martian polar exploration is about to begin, with the landing of the "Mars Polar Lander" (shown on pages 44 and 45) this December. It will land, if not actually on the permanent ice cap, at 72 degrees south latitude (as far south as Point Barrow, Alaska is north) to watch the sublimation of the polar snow as spring comes to the Martian polar regions. Along with the lander will be two "Deep Space 2" microprobes, which, slamming into the soil of the Polar Layered Terrain at 450 miles per hour, are expected to penetrate to a depth of about 6 feet. □

Acknowledgement

This article is based on a paper, "Polar Landing Site for a First Mars Expedition," presented at the Founding Convention of the Mars Society.

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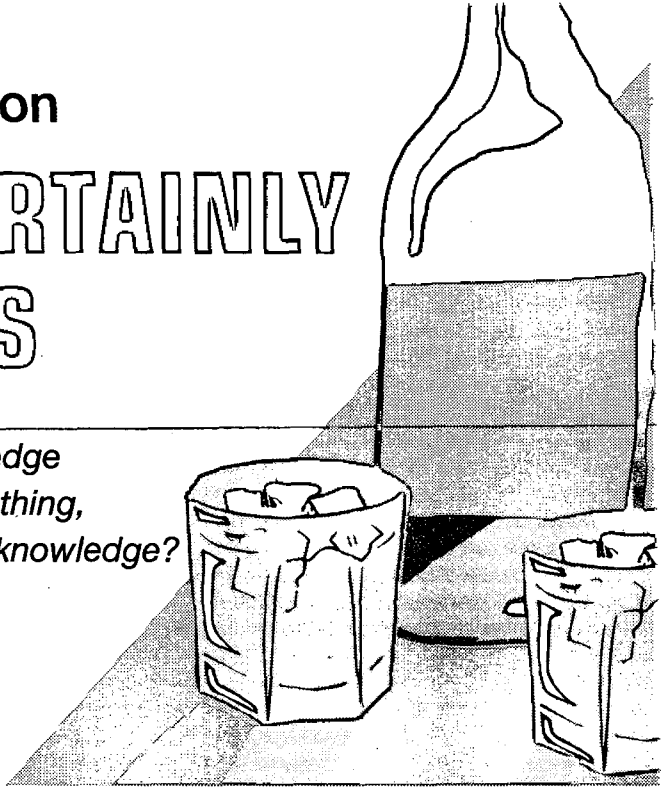
Bill Johnson

UNCERTAINLY YOURS

*If a little knowledge is a dangerous thing, what's a **lot** of knowledge?*



"I'm from the government, and I'm here to help."

He was a medium-sized man, in a medium gray suit, and he seemed to fade into the wallpaper even when he stood in front of my desk. I looked up at him and suddenly realized what he'd said.

He scared the hell out of me.

"I'm with the Federal Trade Commission," he said. He handed me a business card with his name, title, email address, and all the other usual information. I glanced at it, my hands suddenly cold and nerveless.

Everything was all wrong here. First of all, government men didn't come in unannounced. They came with lawyers, or they were lawyers themselves. They also came in herds, at least partly for the intimidation effect. And if you were really in trouble, they called you in to meet with them at their offices, not yours, and they set the time for their convenience.

I was suddenly very nervous.

"My name is Dr. Levent Robinson. I'm with the Accounting department at the FTC. Scientific advisor to the Auditing group, to be precise," he said.

"Accounting? Auditing?" I said. I shook my head. "I don't understand. We're a manufacturing company. A small manufacturing company. A *very* small manufacturing company which has never had any problems with the government."

"And you have no contracts with the Federal Trade Commission," Robinson said reassuringly. "Please, Mr. Hardek, let me reassure you. I'm not here to audit you or your company."

I tried to relax and lean back in my chair, but it just didn't work. I gave up and reversed position so I leaned forward to rest both elbows on the desktop. I waved my hand toward the guest chair.

"Sit down, Dr. Robinson," I said. I waited until he was comfortable. "Or should I call you Levent?"

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"Dr. Robinson will be fine," he said stiffly.

"Now, what do you want to do for us?" I asked, warily. "And do I need my lawyers before you do it?"

"That is certainly your right," Robinson said carefully. "But I think you should hear me out, and then you can do whatever you wish. If that involves counsel, then I certainly can't stop you. Your choice. As for me, I'm probably risking my job just talking you. But my job doesn't seem to matter very much right now."

"You think this is that important?" I asked.

"Yes," he said firmly.

"All right, I'll hear you out first," I said. "What have you got?"

Robinson shifted in his chair, then leaned forward. His hands twisted restlessly in his lap.

"Electricity deregulation is a fact of life," Robinson said. "Anybody can get in the electricity business."

"Hundreds of companies," I agreed, puzzled by his change of topic. "All the money these days is in the distribution business. Plain old electricity generation is boring and low-margin. Too much competition."

"Your company is in the generation business," Robinson countered.

"Only indirectly," I answered. "We provide equipment to the big baseline providers, not the peak time providers. Hell, our customers are the lowest margin of a low margin business."

"You, personally, built this company." Robinson made it a statement, not a question.

The second change of topic surprised me again, and put me off-balance. I nodded, cautiously.

"No one builds a company by themselves. It's a team effort, but, yes, I was one of the founders," I said.

Robinson stood and walked over to my wall. The certificate from Stockholm was hung by itself in a fancy mahogany frame. I remembered when Laura surprised me with the frame, as a present for my birthday.

"Nobel prize for 'Recycled Muon Catalyzed Hydrogen Fusion'," he read. He turned to look at me. "Cold fusion. The basis of our modern society. Cheap energy. Clean energy. No more greenhouse effect. No more waste disposal. Electricity so cheap that it's almost not worth charging for it."

I shrugged. It was true. Muon-based cold fusion had made our world what it was today. Most people hardly even thought about it. Hell, *I* barely thought about it. Of course, in my case that was deliberate.

But the look Robinson gave me made me nervous. He was obviously thinking about it a lot.

"Tell me, Mr. Hardek," he asked, his voice suddenly soft. "How does it work?"

I hesitated, the usual glib answer ready to go, but it would not come out. It was something about the look in his eyes, the intensity.

The fear.

"I don't know," I answered, truthfully and thankfully.

He nodded, as if my answer was exactly what he expected.

"You founded this company. You did all the basic research. You hold all of the patents. You designed the products and brought them into production. And you don't have any idea how they work," he said.

"What about you?" I asked, my mouth suddenly dry. I was suddenly afraid I knew the answer to my own question, but I had to ask. "Mr. Robinson, do you know how it works?"

He nodded, slowly, hesitantly.

"I might," he said. "I just might."

The lights in the room flickered.

"Stop it!" I ordered. "Sit down."

He hesitated for a moment, then half-collapsed, half-sat, down in the chair across from me. He looked at my computer screen for a moment. I had a dia-

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gram on the screen, a proposal for some minor modifications to our muon-reclamation subsystem. Nothing major, just the usual slapping on of chrome and tinsel to make the product seem newer and better. Marketing insisted we needed something new to meet the new sales targets, and this was it.

But he glanced at it, and nodded, and the lights in the room went off again. I heard the high-pitched whine of the redundant power supply I kept under my desk as it kicked in to keep my computer running. I quickly dimmed the screen so he could not see anything, and the lights came back on strongly and steadily.

I found myself breathing rapidly. I reached inside my lower right desk drawer and took out an old, dusty presentation package of Scotch I got from a supplier the previous Christmas. The package included a bottle of Campbelltown single malt and two cut-crystal glasses.

I tore open the package, opened the bottle, and poured us both two fingers of Scotch. I looked over at Robinson, and added two more fingers to his glass and handed it to him.

"I don't drink," he said raggedly.

"You do now," I said. It was an order, and he took the glass. He drained it in three long swallows.

"What have you done?" I asked. I sipped from my glass, poured myself more, hesitated, and refilled his glass. "Correction. What have you *almost* done?"

"The FTC monitors all the different sections of the economy. When we find that some company has more than fifty percent of the market in any area, we start to investigate," Robinson said. He looked up at me. I filled his glass again.

"You have one hundred percent of your market. It's well disguised, with several different puppet companies as fronts, but you supply all the muon-generation and muon-recycling equipment to every cold fusion reactor in the world," he said.

I poured myself a finger more of Scotch, and silently cursed the marketing people. We were going to have to be more clever in the future. If anyone else ever figured out what was going on...

"What's your role in all this? I presume you're some kind of technical expert?" I asked.

Robinson nodded.

"Physics doctorate. I found that it was good for getting a job as a janitor and not much else. So I took the Civil Service exam, and the FTC took me on. I'm supposed to translate the technical information of the companies we look at and feed that data to the lawyers," he shrugged. "It's a living."

"So what else did you find out when you started to look at me?" I asked. I poured him more Scotch, and prayed the lights would stay on. I looked down at my office phone and noted that three of the lines were already lit up. Kay, my administrative assistant, was smart enough to hold all calls while I dealt with the government, but even she had her limits. If all of our customers started to call at once, she was going to funnel calls into me to let me know what was going on.

The problem was, I was pretty certain I knew what was going on. And he was sitting across from me.

"One-hundred-percent market share is a pretty good case, just by itself, for a monopoly charge," Robinson said. "I was ready to recommend we proceed against you, but I wanted to do a little more digging."

"That's when the lights started going out," I said. It was a statement, not a question.

Three times in the last month all the cold fusion plants in the world had stopped running. The first time it was only for five seconds. The longest outage was two minutes. I'd spent hours on the phone since, reassuring our customers and trying to figure out what the hell was going on.

"I started going through the theory

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behind muon-mitigated cold fusion," Robinson said. "It's pretty simple. A muon is just like an electron, only two hundred times heavier. You create them with a particle accelerator. Then you take a chamber full of hydrogen isotopes, like tritium and deuterium, and inject muons into the mix. The muons take the place of electrons and combine with the hydrogen to form muonic hydrogen. But since a muon is so much heavier than an electron, the muonic hydrogen atom is two hundred times smaller than a normal hydrogen atom. Because they are so small, when a muonic atom and a regular tritium or deuterium atom come close to each other, the quantum mechanical fluctuations in the positions of their nuclei force a fusion reaction.

"The result is the two hydrogen atoms combine to form a helium atom, an alpha particle, a neutron, and a free muon, which goes off to find another hydrogen atom and to catalyze another fusion reaction. We use the reaction to provide cheap electricity," he said.

"But there's a problem," I said. Robinson nodded.

"Muons don't live very long," he said. "2.2 microseconds on average. And during that time, the best anyone was ever able to put together was about two hundred fusion reactions per muon, before the muon decayed into an ordinary electron."

I poured Robinson more Scotch, thought about taking more myself. The lights flickered as I thought about it and my mind wandered over to the detailed physics of what Robinson was talking about. I glanced at him, realized he was still rambling about alpha particle interaction rates, and knew the lights weren't his fault this time. I sighed and poured *myself* another shot. God, I hated Scotch. I reminded myself this was an emergency and forced myself to drink.

"You need three hundred reactions to break even on the energy needed to create the muon in a particle accelerator," I interrupted casually. Robinson nodded.

"And it takes about nine hundred reactions per muon to make the process commercially feasible for power generation," he said. "Best I've seen is that, theoretically, you could get the muon to last for about a thousand reactions, then it will decay."

"It was a problem," I admitted.

"You found a way around it," he said admiringly. "You showed that if you could make the muons *slippery*, so that they didn't tend to bind to the alpha particles produced during the fusion reaction, that they could last a lot longer. And then you turned it into a business."

"Oh, there was more to it than that," I said, modestly. "There was a lot of engineering. We had to increase the pressure in the target chamber, to hold more deuterium and tritium."

"Last I read, you were up to one million atmospheres of pressure," Robinson said.

"True. And we had to increase the efficiency of the muon production accelerator," I said.

"But all of this was nothing compared to your work on how to make the muons more slippery. On how to make them live longer," he said.

I stirred, uneasily. This was getting much too close to areas I did not want to disturb. The lights flickered again, and I spoke quickly.

"I'm not certain about that," I said. And the lights came back on strongly.

"That's true," Robinson said slowly. "That's part of the puzzle. Your work always lays out at least two different ways a reaction might occur. And your equipment always lays out two different paths for everything."

"Redundancy," I said quickly. "In case one method doesn't work. Can't let the power stop, you know."

"No," Robinson said, and shook his head. "I thought that, too, but it doesn't work out. You use both routes and both techniques. From your designs there is no way to tell how a muon is created,

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when it is created, how many are recycled. You provide no information at all to the operator. It's a black box. Hydrogen goes in, power comes out. And you know nothing about what happens inside."

He suddenly looked up and stared at me, his gaze very intense.

"That's correct, isn't it? You don't know anything about what goes on inside?"

I hesitated for a moment, and my mind flashed over the designs for the muon generator, the containment field, the recycling apparatus.

The lights flickered.

I quickly forced my mind to think about my wife. Naked. And I drained my glass of Scotch, and poured myself another. The alcohol was giving me a nice buzz, took the edge off my thinking, and made it hard to concentrate.

Which was exactly what I needed right now.

"That's right," I said firmly. "I don't know anything about what's going on inside."

The lights strengthened, and stayed up.

I glanced down at my phone. All the lines except one were flashing, now. Kay was probably frantic. I just hoped to God she kept calm and kept the customers calm. This was going to be over, one way or another, in a couple of minutes.

"So why are you here, Mr. Robinson? What scared you so much?"

Robinson dropped his gaze and stared at his empty glass. I reached out and refilled it. The bottle was three-quarters empty.

"I built myself a simple muon analyzer. Nothing fancy, but it would let me monitor the muon production and recycling rates in your reactor," he said.

"That's when the lights began to go out," I said.

He looked up again, then back down to his drink. He nodded.

"Every time you used the analyzer, the lights went out and the power from the central power grid went out, and the reactor you were working on went out," I continued.

"Yes," he said hoarsely.

"You used it three times," I said.

"Yes."

"And then you found that it wasn't just your reactor. It was every reactor, all the power in the world, which went out," I went on, remorselessly. "You discovered you controlled all electricity production, everywhere. And it scared the hell out of you."

"Yes."

"Welcome to the club," I said. "Have another drink."

"What's going on? What do I do?" he asked plaintively.

I looked at Robinson almost fondly. For twenty years I had carried this thing on my back alone. Everything might be going to hell, but at least I finally had company.

"Remember the old science experiment, where a light beam can go through one of two slits? If it's a wave, you get one kind of pattern; if it's particles you get a different pattern. If you leave it alone, you get the wave pattern even if the intensity is very low. But if you try to see which slit each photon is going through, it collapses to the particle pattern," I said. "Feynman did a lecture on it."

"Simple quantum mechanics," Robinson said. "Just like Schrodinger's cat."

"Exactly," I said. "I had the same problem with my muons. I could get them up to more reactions, about four hundred and seventy-five, with all the little engineering tricks I talked about earlier. But there I was stuck," I said. "Every measurement I took showed that I could not get beyond that number. And I needed nine hundred reactions or more to make cold fusion cheap and effective."

Robinson looked up, his face frozen in a mask of horror. He reached into his pocket and took out a small device. I

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glanced at it, and recognized it as a primitive muon analyzer.

"But now you don't know which path the muons take, or how they got there, or how long they lived," he whispered. I nodded.

"As soon as I stopped looking for information, as soon as I wasn't sure at all how things were working, my reaction events went way, way up. I get nine hundred and fifty now without any trouble. It all happened after I spent a long day at the lab, totally frustrated. I went to a bar, got myself stinking drunk, then came back to the lab. I vaguely remember making some changes to the two different techniques I was engineering. Then I turned the damned thing on to test it, and promptly passed out," I said.

"When I woke up the next day and looked at the outputs, I had the results I wanted. When I tried to analyze the results, to see what changes I'd made to the equipment and how that got me such dramatic results, the reactions dropped way back down to where I was before. As soon as I made random changes, and stopped trying to figure out what was going on inside, everything started to work again," I said.

"You said it yourself earlier. The muonic cold fusion reaction is a quantum mechanical reaction. If you observe it, you force it into a particular path, just like that old high school science experiment," I said.

"So when I started to measure the reactions and understand the system," Robinson said, "I collapsed the system just like you did in the beginning."

"Exactly," I said. "And since we're the only manufacturer for this specialized equipment, you shut down all electricity production, everywhere, every time you tried to take measurements. Even thinking about it, if you understand the system well enough, can shut it down."

I reached across and took the measurement device out of his hand. I turned it over in my hands for a moment. It was really quite good work. I looked up at Robinson, and poured him the last of the Scotch.

"Drink up. I want your brain, and mine, nice and fuzzy. I want us totally confused and uncertain as to how this system works. Then I've got to hire you, you know," I said conversationally. "You need a good salary, and a place where you can do research on anything except fusion reactions. A place where you can keep your mind completely off this problem. The last thing the world wants is for anyone to figure out how things really work."

I raised a heavy metal paperweight off my desk and brought it down on the analyzer. It cracked, satisfyingly, and I hit it again.

"You see, our mothers were absolutely right, " I said. "What we don't know, can't hurt us. . . ."■

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Rick Shelley

AT THE ZOO

Zoos are supposed to be educational, but this one gave new meaning to that cliché!

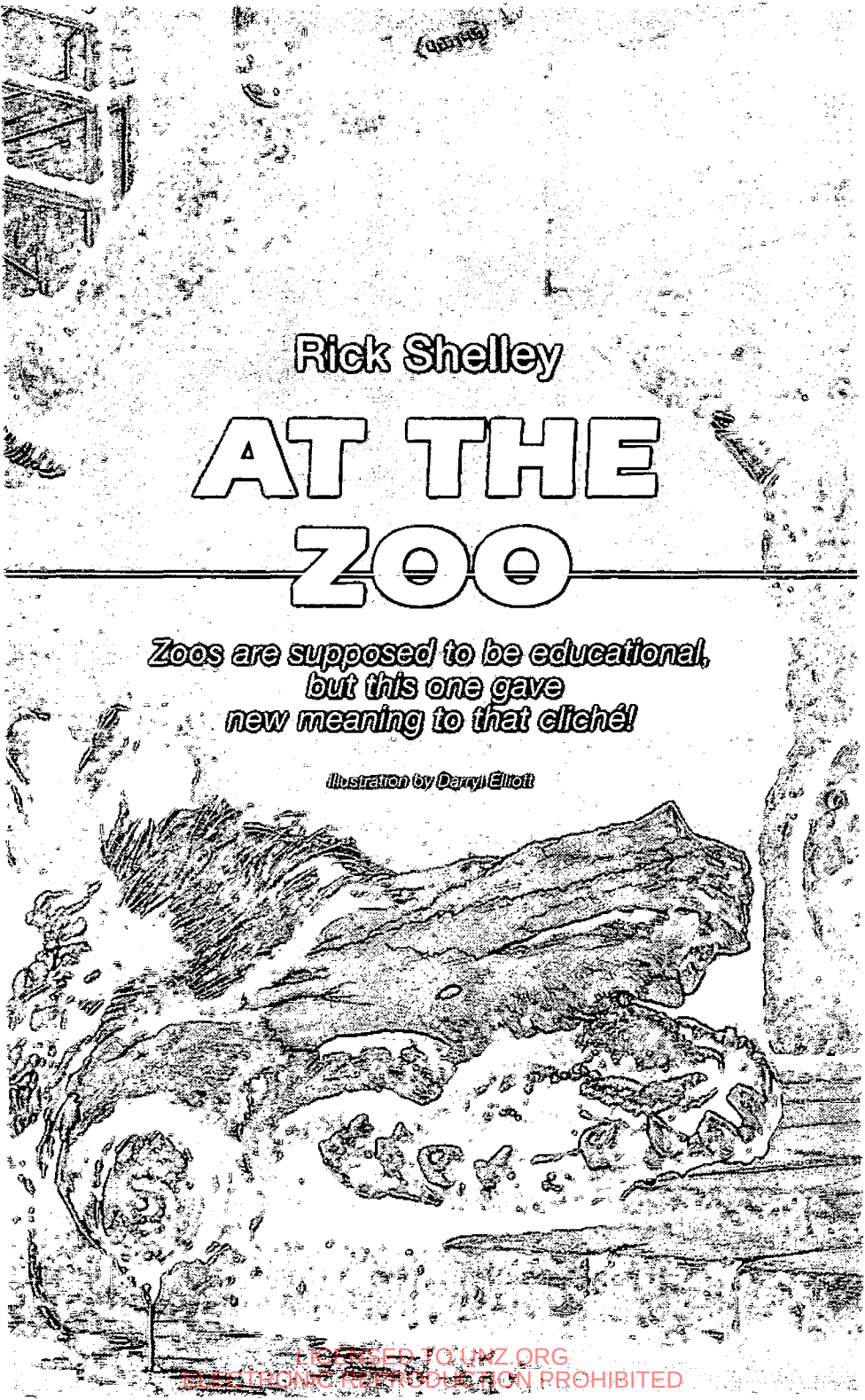

Illustration by Darryl Elliott

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Diane scarcely had time to announce my guests before they came barging into my office. There were three of them, two men and a woman. That was the first time I had ever seen a business suit in such bright shades of orange and yellow, vertical stripes about two inches wide. I squinted against the glare and wished I had a pair of sunglasses I could put on.

"Doctor Katz, I'm Tom Dimson, your account executive." He was the one in the eye-shattering suit. When I stood to shake hands, I noticed that his shoes were plum-colored suede. "This is Bart Dumwoody, artistic director, and Sandy O'Rourke, head copy writer."

"Sandra O'Rourke," the latter corrected, giving Dimson a glare. She was dressed in an electric blue jumpsuit, which made her look as somber as a funeral director compared to her companions. Dumwoody was dressed all in a bright, sparkling emerald green, from his ear and nose rings down to his socks and shoes. He even had green streaks in his hair.

Dimson handed me a business card, showing me its tricks before he let go. It was holographic. Depending on which way you tilted the card, it showed one of the three faces across the desk from me, with a spoken introduction. *Dimson, Dumwoody, and O'Rourke, Advertising Agency Extraordinaire*—that flashed on and off as long as someone was holding the card.

I nodded as I dropped the card on my desk. "Please, sit down," I said, making a vague gesture at the three chairs that Diane had arranged earlier.

O'Rourke sat almost primly. Dimson barely touched the front edge of the chair; he seemed ready to propel himself into orbit at almost any second. His energy level was so high it started to give me a headache. Dumwoody ignored the chairs, me, and his associates; he started roaming around the office, looking at the framed holos and certificates on the walls, and the three video monitors that give me a good overview of the exhibit areas.

"We have a lot of *fantastic* ideas for the campaign for your zoo, Dr. Katz," Dimson said, making extravagant gestures as if he were conducting a symphony orchestra. "But we wanted to come down here in person and get a real emotional *feel* for the project, don't you know. We want to get a close look at all the exotic creatures you have for display, breathe the atmosphere, let the ambiance stir our creative juices. You're sitting on a positive gold mine here—no, not gold, a *platinum* mine!"

"Well, the animals have all survived capture, interstellar journeys, and significant changes in their diets, so I guess seeing you won't kill any of them," I said, deliberating keeping my voice soft. Sandra O'Rourke gave me an infinitesimal smile—the first crack in her mask. To that point, her face might have been porcelain. Tom Dimson blinked several times, very rapidly. At first, I thought that what I had said had gone straight over his head. Then he sucked in a deep breath and guffawed wildly.

"You're all right, Doc," he said. "We'll get along famously. And, here, I was afraid you were going to turn out to be an old stuffed shirt."

It wasn't that the trustees had left me with so little money for advertising that I had to take the cheapest bid. Dimson, Dumwoody, and O'Rourke was a small and new advertising agency, but they already had a decent reputation for getting good results with modest budgets.

"I'll be glad to show you around our facilities, and introduce you to the folks who can give you whatever help you need," I said. *Glad* wasn't exactly the right word, but I can be diplomatic when I have to. If they had been born off-Earth, I might have suggested putting them on exhibit. They were simply too bizarre to be real.

The North American Xeno-Zoological Gardens and Research Center is our full title. We're the only zoo on Earth that ex-

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hibits extraterrestrial animals only. Sure, most of the big zoos have had one or two alien creatures to exhibit. In the early days, that was all anyone could hope to get. Then a group of legislators in Washington figured out that if they put together a top-notch collection of alien animals in a first-class facility and located it in an area that drew a lot of tourists, it might even be a money-making operation. Construction and startup costs were financed by a government-backed bond issue. We're chartered as a for-profit corporation, and already starting to pay back the initial funding. But expenses are astronomical, and we needed to draw even more visitors than we were.

"Currently," I told my garish guests as we left the office building, "we have nine hundred thirty-four animals representing one hundred ninety-two species from twenty-seven worlds." I didn't really expect DD&O'R to be paying attention, but Sandra O'Rourke interrupted me at once.

"I'm sure that doesn't agree with the figures we were given," she said.

I chuckled. "I would be astounded if they did, Ms. O'Rourke. They change almost daily—births, deaths, new arrivals, specimens on loan to or from other institutions. The fluctuations can be . . . considerable, but the trend is up. We have a constant building program to provide suitable habitats for new species. New arrivals clear quarantine almost every week. Births generally outnumber deaths, and the ratio is also improving as we learn more about our charges and how to take care of them. We've only been open for eighteen months."

"How do you select which animals you will display?" Dumwoody asked. "Is it just a matter of taking anything you can get your hands on, or is there more to it?"

I gave a mental nod of approval. Apparently, my guests were interested in what we were doing—if only for the sake of doing their own jobs better.

"No, it's not as simple as taking everything that is available. There are several practical criteria. The animal has to be small enough for transport. The largest creatures that any of the freighters are willing to transport are not much larger than hippos or rhinos. The animals have to be able to survive on Earth. It's not practical to build exotic alien atmospheric environments. We might be able to do that here, but through space is another matter. And they have to be able to eat food we can grow or raise here. The cost of transporting victuals for all those critters would soon become prohibitive. And, finally, quarantine procedures and field research have to rule out the possibility that the animals—or microbes they harbor—could introduce any new infectious diseases to Earth."

We had stopped walking during my exposition. Dumwoody nodded, looking thoughtful. I didn't think it was an act, but I could be wrong. "Practical limits," he said. "But the number of species keeps increasing?"

"Generally," I said. "There's almost always something new, especially if you're talking month to month."

"That's something we can really use," Dimson said. "A sure draw for repeat business."

I had cleared the entire morning for this tour, knowing it was important. I had come to work three hours early so I could get the essentials out of the way first. Long days are nothing new. Sometimes I feel as if I'm shirking if I spend less than twelve hours on the job in a day. There's always *something* that needs tending to. Of course, I spend many of those extra hours just observing the animals. I chose zoo management as a career because I love being around exotic animals.

DD&O'R did a good job of looking everything over—the facilities as much as the animals—even though we were nearly racing from one spot to the next. Ms. O'Rourke detoured to a concession stand and ordered a hot dog. She ate

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only a couple of bites, nodding as she chewed. We went from one building to the next, following the most time-efficient route. My guests listened to my spiel, and occasionally asked a question. Most of those were to-the-point. My estimation of their abilities continued to improve, despite their garb.

"Hey, where'd you get the cute teddy bears?" Dumwoody asked, interrupting my talk about the Fennich firebirds in Number Three building; the firebirds are about the size and configuration of pheasant, but their plumage makes the gaudiest parrot look as plain as a sparrow. They were even able to stand up against the clothes of the ad people. "I know damned well there weren't any pictures of them in the material you sent us." Dumwoody pointed, then moved closer to the Dilorgo exhibit.

Maybe I do have a little of the stuffed shirt in me. I tend to get annoyed when I'm interrupted, but my annoyance was minimized because of the subject.

"They're not teddy bears," I said, following along. "They're not bears at all."

"They *look* like bears, or maybe those koala thingees from Australia," Dumwoody said, and I couldn't fault him for that. They do. The four we have average a little over three feet tall and seventy pounds. The fur varies from gold to a chocolate brown. "People will react to these animals the same way. Beautiful draw. Maybe we could make them the symbol of the zoo, design a logo around them."

"The koala analogy is closer, since they are marsupials," I said. "And, yes, they do look quite a bit like them, grossly. The hands and feet, and general anatomical structure, are more like our primates though. They come from Dilorgo, just cleared quarantine six days ago. We call them Dilorgan ape-bears. The colonists on Dilorgo call them quite a few other things, none of them complimentary. It seems they developed quite a taste for chicken and—according to the reports—proved especially ingenious at getting through any safeguards the settlers put around their poultry."

"Chicken thieves?" O'Rourke said, arching an eyebrow.

"Chicken thieves," I agreed. "And egg suckers."

"We don't have to use *that* in our promos," Dimson said. "We won't really have to *say* anything about them, just show video of them. That's the ticket there."

"Do they do any interesting tricks?" Dimson asked. "I mean, except from stealing chickens and sucking eggs."

I couldn't prevent the frown from sliding across my face. "We're still learning about them," I said. "We don't have a good catalog of their natural behaviors yet."

The ape-bears had moved together in their enclosure, and appeared to be watching us as intently as we were watching them, glancing at each other and making gestures. After a couple of minutes, the largest of the group—the male; golden fur, almost exactly four feet tall—came toward the glass, turned around, and pressed his butt against it, right in front of Dimson. Dumwoody started laughing hysterically, and even O'Rourke smiled.

"Thing mooned you, Tom," Dumwoody chortled. "I told you that outfit was too much."

Yours isn't much better, I thought, but I was enjoying the show as much as Dumwoody was.

"I hope he doesn't do that to paying guests," Dimson said. His face had gotten a little red, but his voice was smooth, no trace of anger.

"I haven't had any reports of it," I said. "I'll tell the keepers to be alert though. It shouldn't be any real problem. For at least the past two hundred years, zoo animals have been getting away with, ah, annoying behaviors. Most visitors generally seem amused by them."

"Behavior like *that?*" Dimson asked.

"Far worse," I assured him. "There have been incidents of primates hurling

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fecal matter at visitors. But don't take the behavior personally. That glass is one-way. What they see from their side is a holographic scene that should remind them of home." It helps minimize the stress on animals. Some would get terribly frantic seeing hordes of people gawking at them.

"That bear's aim was awfully good for not being able to see through the glass."

I shrugged. "It's not a hundred percent, I'm afraid. Some animals do seem to see some of what's beyond."

I was afraid that I would have to lunch with the advertising people, but they said that they needed to do some brainstorming. I think I hid my relief. They told me they would get back to me as soon as they had something to pour in the forms. That was the way Dimson put it.

The zoo's main cafeteria is adjacent to the office building. We don't hide from visitors. Most of the staff eats in the cafeteria, and a fair number of guests do as well. My people know to be polite and answer questions, even if they're annoyed at being interrupted in the middle of a meal, no matter how many crises they've weathered during their shift.

I went through the line, trying to ensure that I got a balanced lunch, then headed for a table. Halfway there, I heard my name being called. Jack Maguire, one of our senior curators, waved for me to come to him.

"Hate to bother you at lunch, Chief," he said as I set my tray across the table from him, "but I think we've got trouble in Number Three building."

"What kind of trouble?" I asked. Number Three housed the Dilorgan animals, including the ape-bears, among other exhibits, such as the Fennich firebirds and Albinian cutthroats—raccoon face on what could almost be a baboon's body, very efficient predators on their homeworld; they have sharp claws and literally cut the throats of their victims.

"That's the hell of it, Chief," Jack said, shaking his head. "I'm not exactly sure. It's just . . . well, strange things have been happening since we moved the Dilorgan animals from quarantine to Number Three."

"You mean like the ape-bears mooning people?"

"Huh?" He got a puzzled look on his face. I told him about the big male's show for the ad people.

Jack shook his head again. "No, nothing with the animals. Mooned him, huh?" He grinned. "Those people who looked like circus clowns?" I nodded. "Maybe those ape-bears got more sense than we give 'em credit for. No, getting back to what I was saying—stuff in back, behind the exhibits. Things turning up missing, or just moved. At first, I thought it was one of the kids working back there, one of the interns. When both of them denied it up and down, I thought maybe one of the robots was out of kilter—you know, it lost a line or two of programming and was screwing things up that way."

"You have the techs check the 'bots?" I asked. With the trouble we have finding enough people to staff the zoo, we couldn't operate without dozens of fairly sophisticated robots moving food, cleaning enclosures, and so forth.

"Twice. Not a thing wrong they can find."

"Anything serious missing?" I asked.

"Well, not exactly."

"Come on, spill it," I said. Jack had a funny look on his face. "What's really bugging you?"

He hesitated before he answered. "Night before last, I left my pocket puter on my desk. In that little cubby I call an office. Just forgot the puter when I went home. Locked the door. I'm damned sure of that. I locked it, then turned the knob and tried to open the door, just to make sure. I always do that, anything that's s'posed to be locked." I nodded. In a zoo, making certain that doors and gates are closed and locked becomes

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second-nature, and it's absolutely essential.

"And?" I prompted when Jack didn't continue.

"The puter was missing when I got to the office yesterday morning. I had recalled that I left it there, and I looked for it first thing because I wasn't sure had I turned it off or left it on. It wasn't in the office."

"Was the door locked yesterday morning when you got there?"

He nodded emphatically. "I got the keycode for that lock and Security has it. Nobody else."

"You check with Security?"

"Just as soon as I was sure it wasn't in the office. They scanned the surveillance videos. No one entered or left Number Three between the time I left Monday evening and when I came in Tuesday morning."

I had done what eating I could while he talked, but I hadn't made a lot of progress. "You are absolutely certain you left the puter in your office," I said. "I mean dead-absolutely-certain." If something had been stolen out of that office, inside one of the exhibition buildings, it might indicate a serious security problem. It was something I would have to act on.

"Sure as I'm sitting here," Jack said. "But just as puzzling is where we found it." He reached into his trouser pocket, pulled out the puter, and set it on the table.

"Where?" I asked.

"In the ape-bear enclosure, under the straw bedding back in the corner," Jack said.

I let out a small sigh of relief. "Well, it must have dropped out of your pocket while you were in there. One of the ape-bears picked it up and hid it."

"No way, Chief," Jack said. "I wasn't in that enclosure Monday. And I did use the puter. My time on it is on the system log. And somebody else used it during the night, put in almost two hours on it, then wiped the log and automatic backups."

"If that's true, it is serious, Jack," I conceded.

"It's true. And then, last night, the cleaning crew found a flashlight in the firebird enclosure."

"I don't doubt you. It's just . . ." I thought for a minute or so, then pulled out my own puter and linked through to Security and identified myself. "The surveillance video of Number Three for Monday and Tuesday. We need a more thorough check. Go back through Monday. See if anyone entered the building before Jack Maguire left for the day and didn't leave until the next morning."

"Where could they have hid?" Jack asked.

I shook my head, then replied to the head of Security. "Yes, I know that's a lot of work, but it has to be done. Today," I added, as he started to protest again. "This could be critical. And check the interior videos as well, the ones in the exhibition hall." We don't keep cameras on the animals around the clock, but we do monitor the concourses and the fronts of the enclosures for security.

"Too bad we don't have cameras in the back areas," I told Jack after I had put my puter back in my pocket.

Jack shrugged, rather extravagantly. "Right now, I'd almost have to agree with you," he said.

"I know, but any other time you'd think it was an invasion of privacy. Anyway, we don't have the budget for it."

"Chief, there's something just occurred to me. If we know, beyond doubt, that someone got into my office, used my puter for two hours, then left it in the ape-bear enclosure; and Security says just as sure, that no one got into the building, then maybe we got a problem in Security."

"Let's not boil our bath water unless we have to," I said.

I couldn't do my job without Diane Thorson, my executive assistant. Without someone as capable and dedicated as she is, I would be stuck in my office

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even more than I am, and I wouldn't like that at all. I got into zoo management because I like being around the animals. As a teenager in Chicago, I worked summers a Brookfield Zoo, and I interned at the Detroit Zoo while I was at the University of Michigan. I returned to Brookfield after I got my degree, and likely would have stayed there if the opportunity to run the xeno-zoo hadn't come up.

The federal government turned over a section of Cherokee National Forest, just across the Little Tennessee River southwest of Great Smoky Mountain National Park, to the zoo corporation. That put us on the maglev route between Knoxville and Chattanooga, one stop south of the tourist hub for Gatlinburg and Pigeon Forge. The area already had six million visitors coming in every year before construction started on the xeno-zoo. This year, our first full calendar year open, the total is expected to approach eight million.

When I returned to the office after lunch, Diane had a list of calls and notes to go over. Some of the items she had taken care of and just needed my pro forma approval. Some of the others were going to require that I return calls or send flits.

"Senator Barnes wants to lay on a VIP tour for perhaps a half dozen people," Diane said after we had gone through the more urgent items on her list. "Next week, Monday and Tuesday."

"Nothing like advance notice," I said. "What's the purpose of the junket?" We're no longer a government corporation, and we no longer receive any money from the federal government, so the junior senator from Tennessee wasn't trying to make sure that our budget didn't get chopped.

"Visitors from Asia. They're anxious to start their own xeno-zoo, and the senator wants to show them how we're doing."

"Barnes will be with them?"

Diane nodded.

"I suppose he expects me to drop everything else and play host for two days," I said, and she nodded again. Politicians coming from Washington or Nashville wasn't a new phenomenon. While we were getting ready to open and during the first six months of operation, political junkets had been routine.

"Take care of the arrangements and confirm the arrival and departure times," I said. "Please." Diane smiled and nodded. "Do we know anything about this proposed zoo in Asia?"

"The way Senator Barnes's aide put it, they're still in the discussion stage. Nothing firm yet."

Which meant they were at least four or five years from getting a zoo built and open, if they decided to go through with it. I wasn't worried about competition from an Asian xeno-zoo even though about seven percent of our visitors are from Asia and Australia. With all of the other tourist draws in our area, we probably wouldn't notice a drop in attendance. By the time an Asian zoo could be built, we might be maxxed out on the number of visitors we could handle.

I told Diane about the possible problem in Number Three building. "I'm going to circulate a flit among all of the senior people to see if anyone else has had similar problems."

"Sounds a little screwy," Diane said, wrinkling her nose. "It doesn't make much sense."

"No, it doesn't. Run a trace on the puter net accounts, see if those were used Monday night into Tuesday morning. Maybe we can get a handle on this through the back door."

Just before the shift changed in Security, I had a call from Pete Albertsen, the department head.

"We've been through all the videos on Number Three, inside and out, from opening Monday to closing Tuesday," he said. "No one stowed away overnight.

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There was no unusual activity during the night."

"No gaps in the coverage?" I asked. "No missing time on any of the feeds?"

"Not a second," Pete said. "I think maybe Jack is just confused about where he left his puter."

I hesitated before I said, "I doubt it, Pete. That puter was logged onto the net for one hundred minutes during the night, while there should have been no people in the building, then the log was wiped. And Jack isn't careless enough to leave it in an enclosure. He says he wasn't even in the ape-bear enclosure Monday, and he did use the puter."

"Then I'm at a loss, Chief. It just isn't possible."

"Pete, don't get in an uproar over this. I hope I'm wrong, but it's something we're going to have to check." I paused, but he didn't jump in. "If the video doesn't show anything going on in Number Three that night, and we know something did go on, the problem might be in your department, someone who could fix the video to avoid leaving evidence."

Pete might have counted to ten twice. The pause was long enough. "I can't see it. That would require collusion between at least two of the four people who were on duty that night—whoever went into Number Three and someone on duty here at the monitors. One bad apple, maybe, but I can't buy two. Not for something so . . . pointless. Any of my people wanted to do a little unauthorized surfing, they've got their own puters. It just doesn't make sense."

"I know, Pete. None of this makes sense. But I do need to have you check it out—quietly and off the record. Maybe there's some outside hacker playing mind games with us. I'm going to have specialists working that angle. If someone can get into our system thoroughly enough to get lock passwords and jazz the surveillance monitors, we could have a major problem. But you and I need to cover this other possibility. I don't want to accuse anyone without full evidence, and I don't want our people to think we suspect them until we know more."

"What do you want me to do then, consult Madame Nene, that psychic?"

"Just do what you can," I said. "We've got Senator Barnes and some Asian VIPs coming in next week. If we've got a problem, I need to know before then."

"My money is on an outside hacker," Pete said. "Maybe just some kid finding out how much he can get away with."

"Someone close enough to come in, find a puter that normally isn't left in that office, and move it inside one of the exhibition enclosures?"

Pete didn't have a comeback for that. Neither did I.

I spent most of Thursday dealing with a foul-up in feed supplies. A truckload of silage for certain grazers of ours didn't pass the spot-check the nutrition department ran. More extensive tests were run on the last couple of shipments from the same distributor, turning up additional deficiencies. Our purchasing director ran into a lot of double-talk, so she brought me into the conversation.

The progress on the investigation into the apparent break-in at Number Three was all negative. The check on security men didn't turn up any new debts or unusual spending. The trace on net usage Monday night showed no pattern that might help narrow down the search, and no progress had been made in locating how anyone might have hacked in. If the problem was a hacker—and that looked more and more to be the case—he was damn good.

Jack Maguire snorted when I briefed him on the interim results. "You know how it goes," he said. "We do catch this hacker, he'll get a slap on the wrist from the courts, then some techie company will hire him for more than you and I make together. If I was ten years younger, I'd quit this rat race and emigrate, move out to one of the colonies."

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I'd said the same thing a few hundred times over the years. Jack didn't mean it any more than I did. There are goers and there are stayers. Jack and I were both firmly in the latter category. There hasn't been a frontiersman in my family since the end of the Civil War some four centuries back.

"You turn up any puter troubles in any of the other buildings?" Jack asked.

"No, but we're still running checks from the other end for unauthorized usage at night."

"I s'pose I'm the only fool who's left a pocket puter laying around," he mumbled.

"Wouldn't have to be a pocket," I said. "There are plenty of desktops available."

Friday, I was on the grounds at dawn. We had a shipment of animals coming from quarantine, and it helps to get new residents located before the public comes in. This was a large shipment, twenty animals of eight species, from three worlds. For me, the most fascinating ones were the pair of flying lizards from Dilorgo. Think six-foot long chameleons, with feathered wings. Only the wings had feathers, in green and orange, darker on top than on the bottom. They were, however, endothermic—warm-blooded. According to the information from Dilorgo, they were omnivorous, preying on small animals and insects when they could, but not above eating fruit and berries—or scavenging. They went opposite the ape-bears, who appeared to take quite an interest, even though they shouldn't have been able to see them through the one-way glass of their own enclosure.

We got everything where it was supposed to be by eight thirty—half an hour before the gates opened to the public.

Jenny, my wife, came with our sons, Ozzie, Jr. and Harold, not long after the gates opened. The boys were twelve and nine, and liked to see new animals as soon as possible.

"I bet I know which new animals you want to see first," I said, looking from Ozzie to Harold.

"The Dilorgans," Harold said before I could name them.

With the most recent additions, we now had five species from Dilorgo. The boys studied them all, playing the puter guides in front of each enclosure a couple of times, even though they had already accessed all that at home.

Jenny also looked at all of the animals, showing nothing on her face. She doesn't have to. I know what she looks for—movement. Jenny fancies herself a dancer and choreographer, though since we got married, her forays into those fields have been with local amateur groups. Lately she had been talking about using the movements of alien animals to stage a radically different version of *Swan Lake*.

Jack Maguire came out and asked if I had anything new on "his" problem.

"Nothing that I know of, but I haven't been to the office yet. I'll let you know."

"Oz?" Jenny called from over by the ape-bear enclosure. I turned and she gestured for me to join her.

"I'll let you know the minute I hear anything, Jack," I said before I went to my wife.

"What is it?" I asked, softly.

"I don't think your one-way glass here works," she said.

"Not perfectly," I said, agreeably. "Some of the animals seem able to see things close to the other side of the glass. Like these ape-bears."

"Not just close," Jenny said. "That big one is following every movement those flying reptiles make in the pen across the way. Perfectly. Watch for a moment."

There were two synthetic trees—bare branches, without leaves that would obscure the view of customers—in the flying chameleons' enclosure. One of the animals was pacing back and forth along the lowest branch, about fifteen feet in either direction, pausing, then going

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back the other way. The large male ape-bear did appear to be tracking that movement exactly. And the lizard seemed to be aware it was being watched.

"I think you're right," I said after several minutes. The concourse between the enclosures is thirty feet wide, and the lights are brighter inside the enclosures than outside—which is supposed to enhance the one-way qualities of the glass.

"I don't think those two species like each other," Jenny said. "Does one prey on the other in the wild?"

"I'm not sure. The ape-bears are said to eat anything they can get their paws on, including eggs. Maybe they raid nests."

"They're both sure nervous about being close together."

I nodded, frowning. "I'm going to have to see if we can do something," I said. "We don't want them under more stress than necessary." If nothing else was feasible, we might have to put a divider down the center of the concourse to hide the two Dilorgan species from each other. I told myself to remember to bring it up the next time I talked to Jack.

I should have gone and talked to him right then.

Saturday morning I was wakened before eight o'clock by a call from Jack. "One of the Dilorgan flying lizards is dead," he said. "I think you're gonna want to see this for yourself."

"See what?" I asked, struggling to get my mind fully alert. "And what are you doing at the zoo so early on a Saturday?"

"I got called in," Jack said. "My first full weekend off in months, this was supposed to be." The head curators for each building normally worked six days on and two off, so there were always some of them in on weekends. Theoretically, I worked strictly Monday through Friday, though I usually made at least brief appearances on my days off.

"What happened?" I asked, still hoping for another hour or two of sleep. Death is a fact of life at any zoo. Animals die, and some die a lot sooner than they would if they were in their natural habitat.

"If we were talking about people, I'd have to say murder or suicide. That's why I think you need to see this for yourself."

I looked at the clock. "I'll try to get there before the gates open."

Jack was standing outside the entrance to Number Three building when I arrived. It was ten minutes till nine, and there were long lines at both of the zoo gates.

"I hope you're not going to tell me we need to keep the building closed, Jack," I said. "People know we've got new animals here. They'll be disappointed if they can't see them."

"You see what we've got, then you tell me," Jack said, leading the way in and off to the locked door leading to the access alley behind the enclosures on the side of the building that held the flying lizards. One of the keepers was standing at the top of the stairs that led to the basement. That was close to the lizards' enclosure. The door to that was closed but the bar was not across it.

"Billy's inside," the keeper, Stan Norton, said. Billy was Billy Garcia, another keeper.

Jack opened the door to the enclosure slowly, looking in as soon as it was ajar. Billy was right inside the doorway.

"Th'other one hasn't moved a bit, Mr. Maguire," Billy said. "Just cowering there on that branch, shiverin' like."

Jack stepped into the enclosure and I followed. Billy seemed surprised to see me. He nodded then said, "Dr. Katz." He shook his head slowly. "This is the weirdest thing I've ever seen here."

"Over there, Chief," Jack said, pointing toward the left wall of the enclosure.

One flying lizard was lying on the floor, almost against the wall. Above it, eight feet up, there was a bright smear

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of blood on the wall, with streaks showing where it had dripped. The blood was more orange than red.

Jack started walking across the enclosure. Before I followed, I looked for the other flying lizard. It was on the highest branch of one of the fake trees, pressed against the trunk. It was moving now, a little. Its eyes followed Jack.

"I can't say absolutely for certain, Chief," Jack said when I joined him over the body of the dead lizard, "but it looks as if it flew full speed into the wall, like it was trying to get away from something. Or someone."

"I think these birds—lizards—and the ape-bears can see each other through the one-way glass, Jack. I meant to mention that yesterday and didn't get a chance. The flying lizards seemed stressed out by having the ape-bears watching them."

"I noticed," Jack admitted. "Thought maybe we should do something about it." He looked at the bloodstain, then at the dead animal. "Guess we should have done something right away."

I glanced at my watch. It was a couple of minutes after nine. People would be streaming in through the gates. Some might reach Number Three almost any second. I turned. "Billy, go to the control panel and opaque the glass for this enclosure, then put up one of the signs outside that it's temporarily out of service." I glanced up at the remaining flying lizard. I really didn't want to show that specimen off—to say nothing of its dead mate and the blood on the wall.

After Billy left, I turned to Jack again. "If this thing killed itself flying into the wall, it must have been traveling incredibly fast, especially for an enclosure the size of this. I wouldn't think it possible."

"There's something else, Chief. If this lizard was trying to fly away from the ape-bears it could see across the way, it would have gone into this back wall, not the side of the pen. If it was flying from something, it was from something coming in the door. Or someone came in, got hold of it by the feet, and smashed its head against the wall."

I squeezed my eyes shut, just for an instant. "Your security problem again?"

"It's possible. Have to go through the security videos again, check the logs. This is bigger than someone using my puter for a couple hours, Chief. We've got ourselves a full-fledged felony this time."

"If it was an outsider breaking in," I said. "This still could be what it looks like, this animal smashing into the wall on its own, killing itself by accident. Even if it thought it was running from something, that doesn't mean there was anything or anyone in the enclosure with it."

We got guards in to document the scene, and called the local police to make sure we were on record if this did turn out to be criminal activity. The remaining occupant of the enclosure had been removed by then, taken to the veterinary clinic where it could be sedated and observed, given a chance to recover from the shock it seemed to be in.

It was the middle of the afternoon before I was able to go to the clinic to talk to the duty vet. She had just finished the necropsy on the dead flying lizard.

"There's no indication that the animal was bashed against the wall by anyone," Wanda Bwese said. "It looks as if it flew into that wall on its own. The wounds are entirely consistent with that."

I nodded, then said, "What I don't understand is how it could get moving fast enough in the confines of that enclosure to do so much damage."

"It really doesn't take all that much. The bones are fairly fragile, as in many terrestrial birds. Any flying creature has to minimize weight. Strong musculature is essential. Dense bones are not." She shrugged.

"What about the other lizard?"

"I don't know if he'll recover. There are no injuries. I'd guess that it's still in shock. Scared, maybe. Terrified. I just don't know enough about the species.

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People haven't been on Dilorgo long enough for us to have complete information on the native life." She shrugged, a tired motion. "If it does recover enough for me to release him, I'd make two suggestions. First, don't put it anywhere near the ape-bears. Second, find another mate for it as quickly as possible. Even that might not work. If the species normally mates for life, as one of the reports I have opines, it might not accept a substitute."

"I don't think there's another one of these flying lizards on Earth, Wanda. Might not even be one in transit."

"Then hope it can thrive without its mate," she said.

It was a small point, but the only guards who were on duty the nights of both incidents in Number Three were the men who had manned the monitoring console in the Security office on each shift. That meant that if guards were involved, there had to be at least three in on it—and I was inclined to dismiss the possibility of collusion on that scale. We take extreme precautions in investigating applicants for guard positions.

The zoo is minimally staffed at night. A cleaning crew works evenings, making certain that the day's messes are cleaned out and the park is ready for opening the next morning. A few handlers are on duty, or on call. Some of the animals need to be fed at night. But apart from that, most of the night "staff" consists of robots programmed to observe, with built-in links to call the proper human if anything out of the ordinary happens. They can even trigger the sprinkler system before calling the fire department if a fire should start. The 'bots occasionally spot health problems in their charges before the human keepers and curators do. They're that good. They patrol the concourses outside the hours the zoo is open, and each enclosure has peepholes designed for the 'bots to use along the access alley.

I wish we had more of them. But until the zoo's income increases, we're limited to one or two per building. That means they can't watch every exhibit every minute.

Sunday, I didn't go into the zoo until an hour before closing. I checked the gate stats and found that attendance was three percent above the projections. Concession receipts were up by about the same amount. The Dilorgan ape-bears were drawing visitors. I could tell that by the number of people who went into Number Three—more people than came through the gates, which meant visitors were going back for a second or third look—and by souvenir sales. Stuffed and plastic replicas of the ape-bears were selling as fast as they could be put out on the shelves, and so were postcards, holographic prints, and anything else with the animals on them.

The opaqued enclosure where the Dilorgan flying lizards had been housed stuck out like a giraffe in a flock of penguins.

I was in the building when the announcement was made that the zoo would be closing in fifteen minutes. There were still seventy or eighty visitors on the concourse. A few people started toward the doors, but five minutes later when the keeper and two guides came through to urge people out, there was still a respectable number there.

Jack Maguire came out into the concourse two minutes before closing. It looked as if he was wearing the same clothes I had seen him in the day before. And he obviously hadn't shaved.

"You been here all weekend?" I asked.

He shrugged. "Couldn't ask any of the kids to do it without pay. This building's my responsibility. Too much been happening." He gestured toward the blank enclosure. "The doc thinks that other flying lizard will have to be put down. It's not responding, not coming out of its shock."

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"You had any sleep?"

Another shrug. "A couple of hours, I think, this morning."

"Go home, Jack. You can't do any good if you're a zombie. You and I are too old to go without sleep two nights running."

"I'll be OK, Chief."

"No, you won't, and it wasn't a suggestion. You're not doing yourself or the zoo any favors hanging around when your eyelids look like they're about ready to drop to your knees. I'll program the 'bots here to download their video files to the security server every hour instead of erasing them." It takes too much memory to keep a permanent record of everything the 'bots see. Normally, only "incidents" are saved—anything they are programmed to regard as out of the ordinary.

"I did that about two this morning, when I was afraid I might fall asleep," Jack said.

"Go home. Senator Barnes and his guests are going to be here tomorrow, and I need you alert then, not looking like you're on a hangover from a three-day drunk."

For a few seconds, I thought he was going to continue arguing, but eventually he nodded. "I got a few things in the office. I'll get those."

"I'll go with you." I planned to stay with him until he went out the employees' exit, and until he got to the maglev stop if I had to.

We don't have any open-air exhibits. All of the specimens are in climate controlled buildings, their air segregated from the visitor concourses, filtered coming and going to further minimize the already minuscule risk of introducing new pathogens. To make sure that visitors get as much of the flavor of the exotic animals as possible, pickups in every enclosure pipe sounds out to the concourses. And the air conditioning adds traces of exotic animal scents to the air the visitors breathe. Without those devices, they might think they were in an art museum rather than a zoo.

It would have been nice to have herds of Filanian antelope hopping around two or three acres of grassland, in something approaching their natural habitat, but public relations concerns—more than real health dangers—still make that impossible. A political situation. Someday, maybe after we've been open another five or ten years without any health incidents, we might be able to get away with it, but not yet, not soon.

When I got to Number Three, the cleaning crew—a keeper, two cleaners, and a 'bot—were entering the ape-bear enclosure. On a whim, I went back through the access alley to the pen, and went inside, to lean against the door while the crew worked.

It was the first time I had been inside the enclosure since the ape-bears had moved in. I was struck by the smell, sort of a cinnamon overlay to the usual odors of straw, waste, and animals—pungent, but not all unpleasant. The ape-bears had been around long enough to know the routine. The four of them moved to the near front corner of their enclosure while the cleaners worked the other half, then switched corners as the team moved back to the near half. They watched intently—though this time the male, the largest of the four, spent more time staring at me than watching the cleaning crew. That figured. I was the anomaly. I wasn't there every day.

The ape-bears were docile. As long as no one made any quick moves in their direction, and they had fleeing room, they were content—not like some of our animals. Or any other. But the keeper and the 'bot kept wary eyes on them, and both had devices to stop any attack without seriously injuring the animals. We try to take nothing for granted. There are too many unknowns and too much "according to best information" to get slipshod.

It didn't take the crew long to sweep

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old straw and waste into the recycling channel concealed below the level of the glass wall that fronts the enclosure. A quick spray of water and disinfectant. New straw for bedding, delivered by conveyor belt above the ceiling and dropped into place to be spread by the crew. The keeper ran a quick inventory to make sure nothing was left behind. We all made our exit.

"Checking up on us, are you, Boss?" the keeper, Ned Bundt, asked with a smile.

I returned the smile. "Just curious about the ape-bears, Ned. They're drawing a lot of attention."

"I think Mr. Maguire is getting a touch of paranoia over them. Says everything's going to hell since they came in."

"Just be extra careful doing your final go-round before you leave for the night. I know you're careful all the time, but until we find out who's behind the hacking, let's humor Jack."

I went downstairs to check Jack's office, make sure that he hadn't forgotten anything. For just a moment, I considered sticking around through the night. Maybe Jack's paranoia was contagious. But good sense prevailed. With VIPs coming in the next day, I had to get my sleep, be on top of my form. Monday was going to be a busy day, even if nothing new went wrong.

In the morning, I got to my office before seven thirty. Diane had beat me in, by ten minutes, she said.

"Senator Barnes and his party will arrive at the maglev station at eleven forty-five," she told me. "I have the carts reserved to pick them up. Lunch in the cafeteria. The corner section by the windows will be set aside. There will be a special menu for the occasion. That was coordinated with Senator Barnes's office. The chef wanted to know if our visitors had any preferences or aversions. We've set aside ninety minutes for lunch, to leave time for talking. The rest of the afternoon is available for a tour. You and Mrs. Katz will host dinner at Continental Hof in Gatlinburg. The transportation for that has all been arranged as well. Our guests will be staying there."

"Does the schedule say when we have time to scratch our butts?" I asked as innocently as I could manage.

Diane ignored the comment. "The schedule for tomorrow isn't firm. Senator Barnes's aide is apparently unsure whether the group will return to the zoo in the morning. Tentatively, they will come out for an hour's conference, to go over any points they aren't clear on. My impression was that the senator would prefer to head straight back to Washington in the morning, but isn't certain whether he'll be able to convince his guests."

"You have cleared the arrangements for this evening with Jenny?" I asked, needing the confirmation of Diane's nod.

"I just got off the link with her before you walked in."

"Put the schedule on my terminal and on my pocket puter. I'll try to get it memorized, but I may need a reminder."

"The copies are already downloaded, and the memos will be beeped to you as necessary."

Of course. Lady Efficiency my assistant is.

"Anything else I need to know about this morning?" I asked.

She hesitated for about the blink of an eye. "I'm not certain that you need to know this right this minute, but those advertising people want at least an hour of your time to go over their preliminary plans. They wanted in this morning. I told them that it was impossible anytime today and that you would try to see them as early tomorrow as possible."

"They're still here?" I was surprised. I had thought they were heading back to New York Thursday evening or Friday morning.

Diane wrinkled her nose. "Mr. Dimson said something almost entirely inco-

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herent about the flow of creative juices and being so 'shimmered' that they decided to stick around and put the tabs in the slots right away."

"Shimmered?"

She shrugged. "I couldn't find a definition that made sense in any of the usual references. I may have misunderstood what he said. Half the time he might have been speaking ancient Mayan."

"How did they take being stalled until tomorrow?"

"Not with especially good grace, but I explained you would be tied up with government people and could not be disturbed for even five seconds. I may have suggested that the government security detail would cart anyone who tried to crash the conference off to the nearest FBI office for questioning. Mentally, I tried to project images of bright lights and rubber hoses. I think they assimilated the essence of my message."

Diane grinned and I laughed out loud. "You might have told him that the senator has a marked aversion to any clothing more garish than gray pinstriped suits."

"Does he?" Diane asked.

"Beats the hell out of me."

I started working through the mail, memos, and reports Diane had for me. First in the queue was a follow-up report from the outside specialists who were trying to track down the suspected hacker. I had asked them to check all of our netlinked puters' logs for the last month, and to backtrack farther if the initial search suggested that it might be necessary.

"Our initial security scan of netlink traffic suggests that your system has been regularly compromised over the past eleven days. Different terminals or pocket puters were used, but we have located unauthorized usage almost every night in this time frame. During the prior nineteen days—nights—there were zero incidents. With your approval, we will extend our search back one additional month. If there were no unauthorized links during that period, we might safely conclude that the problem is new, that it began eleven days ago."

The letter went on to detail the steps that were taken, the amount of net time that had been "stolen," sites that had been visited, and so forth. The next section detailed the cost of the unauthorized usage. Finally, there were proposals for preventing further incidents and for tracking down the culprit.

I was just starting the last section when Diane buzzed me on the intercom.

"There's a problem in Number Five building," she said. "An animal missing. Mr. Klip thinks you should come right away."

"Missing?"

"That's what he said. He sounded . . . a trifle overwrought."

"I'll go right over." A missing animal is a major event in any zoo, and in ours it could be something else. "Has he got Security out looking for the animal yet?"

"He didn't say. I'll call Security directly and get them moving if he hasn't reported it to them," Diane promised.

"Did he say what was missing?"

"No, and he didn't give me a chance to ask."

The xeno-zoo had never had an animal escape, but we have a standard operating procedure to deal with such an eventuality. It's pretty much an all-hands affair, drawing every available employee to search the grounds . . . or look for a trail. Even the young people who work the concession stands are used. If we know, or suspect, that an animal has left the compound, there is a list of authorities to be notified to expand the search . . . and to warn people if there is any conceivable danger.

It is *supposed* to be impossible for any animal to get out of our enclosures—except, of course, as a result of human carelessness. A door left open and un-

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guarded could provide an avenue out. But in that case, we should have immediate knowledge of the escape. For a building curator to come in at the start of the day and find an animal *missing*—that was something I had trouble accepting.

Our Number Five building is near the eastern perimeter of the zoo. I needed ten minutes of fast walking to reach it. When I got there, I saw Jurgen Klip, the building's head curator, on the narrow walkway above the access alley, checking the clerestory windows for one of the interior enclosures. It's a secondary path for visitors, letting them look down into the exhibits. A security officer was with Klip. Other employees were going around the perimeter of the building, looking through the low hedge that bordered the structure.

"Jurgen, what happened? What's missing?" I asked.

Klip turned and said, "One of our Plymouth dillers. I'll be right down."

The dillers got their name through a strong resemblance to armadillos. They were oviparous animals that were biologically more like echidnas—spiny anteaters. They were nocturnal, burrowing animals. Full-grown, they might reach two feet long, and about thirty pounds. We had six adults. Two of those had laid eggs, though none had yet hatched.

Jurgen Klip was habitually red-faced—florid—but he now looked as if his head might explode from extremely high blood pressure. A big man, his neck was as broad as his head.

"How did it happen?" I asked when he got down to me.

He sputtered before he could say, "I don't have any damned idea. The enclosure is secure. The access door was locked and barred. We haven't found any holes."

"Sounds as if your diller got swept into the recycler channel while the enclosure was being cleaned last night."

I could almost see steam coming from Klip's nose when he snorted. "That was my first idea too," he said. "But if something like that had happened, the 'bot with the crew should have recorded it and downloaded it as a reportable incident, and the crew and keeper would have reported it at once and stopped the channel conveyor so we could rescue the animal. I've already talked to the keeper, and he swears nothing happened, that all six dillers were present when they left the enclosure."

That still seemed to be the most likely explanation, with the keeper, and perhaps the human cleaning crew, prepared to swear otherwise to avoid losing their jobs. But we couldn't simply make that presumption.

"We'll continue searching, and have Security check their videos for any sign of intruders."

"They're already doing that," Jurgen said. "There were no alarms, and the doors were all properly locked when I got here this morning."

I was on my pocket puter, calling Diane to have her implement the full call-in for the search when I heard a series of whistle calls—short-long, short-long. I asked Diane to hold for a minute while I checked out the whistles. A security officer came running into sight around the corner of the building and gestured for us to follow him. Jurgen started running, and I was only a step behind him.

"We've found your missing animal," the guard said. "What's left of it, anyway."

He led the way back around the building, then pointed toward Number Seven building. At a crosswalk halfway between the two structures, two men were standing over an open manhole. I saw the head of another guard down in the hole.

"Something had the diller for supper," the guard in the hole said when Jurgen and I reached him. "Nothing left but the armor plates and some bones."

"Get out of the way, we're coming down," I told him, and the guard went

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back down the ladder to the floor of the tunnel. I went down quickly, with Jurgen almost tramping my fingers in his hurry to follow.

The tunnel system is part of the zoo's infrastructure that the public never sees. Inside the tunnels are the air ducts, water and waste pipes, and so forth. All of the buildings are connected to the system. Usually, it's the realm of our engineering department.

I saw the remains of the diller, half-shoved under the recycling system pipe. The guard flashed his light around the area. There were bloodstains on the concrete around the bones and armor plating of the diller. There was no doubt what the dead animal was.

"Two mysteries now," was the first intelligible thing Jurgen said after a string of incoherent swearing. "How did the diller get out of its cage, and then what the hell do we have roaming around down here that could kill and eat it?"

"Jurgen, I'll need you to coordinate this for now. I've got those bigshots coming in from Washington. Get with Security and organize a complete search of the tunnels. Track this back to the building and see if you can find out how the diller got into the tunnels from its enclosure. Make sure there's always someone around with a tranquilizer gun in case you run into the predator. And, for God's sake, keep this quiet. I don't want visitors to hear that there's something on the loose."

"Best have everyone do a check of their animals," Jurgen said. "Make sure we don't have something else missing, something that could have done this."

Well before nine o'clock, I knew that no other animals were missing from their enclosures. I took both sides of the argument—whether we should open on schedule or not—and decided there wasn't sufficient reason not to. I had Diane notify department heads to call in as many of their people as they could reach—those who were supposed to have the day off. The night watch from Security would be held over four hours. The evening watch would be called in four hours early if we hadn't found whatever ate the diller by then. The service tunnels were being searched. There would be plenty of eyes above ground as well, looking for the eater and watching out for the safety of visitors.

With a little luck, none of our visitors would know that anything out of the ordinary was going on.

I stayed out on the grounds, and going through exhibit buildings, until I had to head to the maglev station to greet Senator Barnes and his guests. And while I was in the cart enroute, I used my pocket puter to make a last series of calls to building curators to check on the progress of the search.

We have a tight maglev schedule. During the day, a two-car train arrives every twenty minutes from the tourist hub. There is a ten-minute layover before it heads back there. Once an hour there is a stopover by the maglevs on the Knoxville-Chattanooga run on the main line. The transit authority had provided a private train for the senator's party, and adjusted the schedules for the flanking maglevs on the run to the tourist hub to avoid getting them in too tight.

I had met Eric Barnes a number of times—I had appeared before his committee quite frequently. As the senator, his guests, and an entourage of twenty others, got off the maglev, Barnes made the introductions.

Matthew Sun was a Methodist minister from Beijing, and head of the Asian delegation exploring the requirements for starting a xeno-zoo there. Sun was ninety years old, his jet black hair starting to show a little gray at the temples. Thin and meticulously dressed, he had a smile and a slight bow over our introduction. The briefing material said he was a distant "connection" of the emperor in Beijing. His companions were Angus McDougal from Sydney, and

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Tamiko Toki from Yokohama. McDougal was of average height and burly in build, with washed-out blond hair and brown eyes. He was in his middle forties, about my age. Toki was a few years older, but looked far younger. She was the immediate past president of the Japanese Imperial Zoological Society. They were both zoological professionals. I knew McDougal by reputation, and I had corresponded with Toki.

"We are quite impressed with the success you have had here," Dr. Sun said during the electric cart ride to the zoo. "We have followed your efforts from the beginning. The fact that you have been able to operate so well is what has encouraged the governments of the Asian Federation to make plans for our own xeno-zoo." Zoologically speaking, Sun was an amateur, but a knowledgeable one . . . and he had the proper political and family connections for his position on this committee.

"Whatever assistance we can provide, we will be more than happy to," I said, trying not to let the flattery go to my head. "It is somewhat more complicated than managing a collection of more familiar animals from our own world, but it can be done."

I ate lightly. My stomach would not accept too much. All I could do was hope that there would be no incidents. I had mental flashes of some strange animal running loose, threatening paying customers. *Something* had eaten that diller. After the lunch and talk had about run their courses, I excused myself for a moment and went off alone—to call Diane to see if the mysterious diller killer had been located, or identified.

"No," she said, "but there have been no sightings of it by our guests either, and the search of the tunnels and buildings hasn't turned up anything. Whatever it was, it doesn't seem to be on the grounds any longer."

"If it's gone, it's somebody else's worry," I said, but I didn't take much consolation from the possibility. I couldn't convince myself that we would get off so lightly.

An afternoon wasn't long enough to give our foreign visitors a complete tour of every animal and every detail of our operation. Diane and I had arranged our itinerary to show off some of our prize exhibits, and the provisions made for different species. Despite the problems we had had in Number Three building, I had to show off the Dilorgan ape-bears.

Jack Maguire met us. I introduced him to our guests, then let him conduct the tour. He had been briefed on which exhibits to feature. He started with the ape-bears.

I suppressed a groan when I saw Dimson, Dumwoody and O'Rourke near the ape-bear enclosure. Dumwoody had a video camera, and he was shooting the ape-bears, moving along the front of the enclosure. O'Rourke was talking into a pocket puter. Dimson was on the far side of the concourse, against the blank facade of the enclosure that had held the flying lizards, staring, looking as if he were in a trance. The three were dressed more conservatively than the last time I had seen them, if still not in anything I would have worn on a wager.

Please, don't let them see me, I prayed silently. I was behind the VIPs, staying out of the way while Jack gave his spiel about the ape-bears. I tried to will myself a cloak of invisibility, knowing that such things were pure fantasy.

For a time, I thought I might escape the notice of the ad people. The ape-bears were putting on quite a show. The big male had his harem lined up, backs to the glass, and he was going from one to the next, mating with each in turn. I would have been appalled by that if I wasn't worried about what the ad people might say or do.

"Quite a randy old bloke, that one," Angus McDougal said with a chuckle. He gave me a soft jostle with his elbow. "He do that every day?"

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"Not that I know of," I said, speaking softly to avoid interrupting Jack's talk. "I think he's doing it for the benefit of the camera." I pointed. "The ape-bears seem able to see past our one-way glass." Then, to cover myself, I added, "The man with the camera is part of a team here from our ad agency. They've taken a shine to the ape-bears, like many of our visitors."

McDougal chuckled again. "I know, they look like koalas, and folks all over go bonkers over them."

The two of us stepped back a little from the others. "I think the male took a dislike to the ad people from the start. The first time they came in here, he mooned them."

This time, McDougal laughed fully, enough to make Jack pause in his talk. Dr. Sun glanced at us. It was while McDougal was apologizing that Tom Dimson took notice of my presence. He straightened up, then came toward us.

"Dr. Katz, I know you're busy, but if I could have just ten seconds?" Dimson said as he approached.

I apologized to my guests, then introduced Dimson to them.

"What is it?" I asked then, moving off to the side and nearly dragging Dimson with me.

"We're having a little difficulty getting usable video of the ape-bears," Dimson said, speaking rapidly. "We'd like to plant a camera inside their cage. Maybe when we're not around they'll act normal."

"Fair enough. I'll tell Jack Maguire to set it up, as soon as I get a chance."

"We would like to get this done quickly," Dimson said. "We had hoped to head back to New York tomorrow."

Rather than argue, I pulled out my puter and called Jack to give him the message.

The rest of the day went smoothly, to my unending relief. We finished the tour, covered some of the fine points of the operation, and so forth. The dinner that evening also went as well as can be expected. I don't particularly care for formal entertaining, but I've become resigned to it. Jenny and I didn't get home until after midnight, but I still managed nearly five hours of sleep before I was wakened. Jack Maguire called.

"The big ape-bear, the male, is gone," he shouted as soon as I answered.

That shocked me to full alertness. I felt a sinking feeling in my gut, and *Oh, no!* flashed through my mind. "I'll be there as fast as I can make it, Jack. Any idea what happened?"

"I came in early, just to have a good look around. The ape-bear enclosure was locked, but the male was gone."

"Get that camera the ad people left. That should give us a good idea," I said.

"Damn!" Jack said. "I forgot about that. I'll get it now."

It wasn't seven o'clock yet when I reached the zoo. Jack met me at Number Three. He had a video camera in a plastic bag at his side.

"This isn't gonna be any help," he said, lifting the bag. "I'll show you what we got, in the office." While we were on the way there, he told me that he had rigged the camera through our net because the camera's memory chip would only hold two hours of video and the ad people wanted continuous coverage.

"Here's the last minute of good video," he said when he switched on the desk puter and keyed the playback.

The camera had been placed high, in the corner, well out of reach of the ape-bears. The angle was good, showing nearly the entire enclosure. I watched the playback as the male hurled wads of dung, until one covered the camera lens and stuck.

"I guess they didn't fancy being on camera," Jack said.

"What time did that happen?" I asked.

"Just before midnight. The cleaning crew was in there around six thirty. Guess they needed time to get enough . . . ammunition. There's another problem, or

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another part of the same problem. One of the 'bots has jammed."

"Jammed?"

"Standing in the access alley showing itself video of it going about its business. A loop. I used the puter to link to it, but I didn't touch the 'bot. Security will want to inspect it, I suppose."

"I'm sure. You've got the search started?"

"Everybody who was on the grounds. I need authorization to call people in early."

"Do it." I started to continue but stopped because my pocket puter started beeping. I pulled it out and saw a message on the screen.

COME TO YOUR OFFICE AT ONCE.

"Now what?" I tried to signal back, but there was no reply. "You get things started here. I'll be back as soon as I can," I told Jack.

I didn't *quite* run.

Maybe I should have seen it coming, but I didn't—even when I opened the door to my office and saw the missing ape-bear squatting on my chair the pieces didn't fall into place. I closed the door behind me and started to reach for my pocket puter so I could tell Jack to forget about the search. The how and why of the situation weren't even questions in my mind yet.

"I think it's time we had a talk." The voice was high, reedy, the way a human sounds after inhaling helium. At first, I didn't really notice it. The shock of hearing an *animal* talk was too great.

I was still thinking *animal*. I leaned against the door—nearly fell against it. My brain was racing but not getting anywhere. I can't even say how long my confusion lasted. My first remark, when it came, didn't show a great deal of intelligence.

"You talk!"

The ape-bear hopped out of the chair and landed easily on his feet. The jump almost caused my heart to stop. Instinct told me he was coming for me. Instinct was as big a fool as the rest of me.

"You look as if you need this contraption more than I do," the ape-bear said, pointing at the chair. He moved toward the window and perched on the narrow sill, a delicate balancing act.

I was nearly catatonic. Only slowly did my brain start functioning the way it's supposed to.

"What's going on?" I asked, finally taking one shaky step toward my desk and chair.

"Sit, and I'll tell you," the ape-bear said. It was about then that I noticed the quality of the voice for the first time. He waited until I was seated. I dropped onto the chair rather heavily, and turned it until I was facing him directly.

"I made a mistake," the ape-bear said. "I didn't get back to my quarters in time this morning. So I came here."

I took several deep breaths, still fighting for composure. "We had no idea you were, ah, intelligent. Sentient. And we've had colonists on Dilorgo, your world, for more than a year."

"We had to be sure about you first. When your people arrived, we pulled back into the deepest layers of our caves and watched. After a time, we let ourselves be seen—a very few of us—to see how your people would react. Then we found ways to observe more closely, to learn your language. The newcomers thought we were cute. They wanted to touch us, hold us." There seemed to be a little revulsion in his voice, but I couldn't really be sure. "They wanted to make pets of us."

He was silent for a time. I could think of a thousand questions to ask, but I kept my mouth shut, watching, waiting.

"My mates and I allowed ourselves to be captured, so we would be able to observe more closely, see what happened inside the buildings the newcomers erected. We learned to manipulate your communications equipment. And learned ways we can improve our own someday.

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"When we heard our captors talk about shipping us to their homeworld, we decided to permit it, knowing that knowledge would come more quickly where there were more people to observe. We did not anticipate . . . *this* place, but we learned to cope. I was able to reprogram the simple automatons that had access to our quarters, and after that, it was simply a matter of caution, of not permitting myself to be seen outside of those quarters. I learned how to use your main communications system, and that allowed me to access much information very quickly."

The office door opened during that last sentence. Diane was on her way in, unaware that there was anyone in the office. She saw—and *heard*—the ape-bear and dropped her pocket puter. Diane did not scream or faint. She seemed to assimilate what was going on a lot faster than I had.

"Tell Jack to call off the search," I told her. "Don't tell him anything else." She nodded. "And see if you can catch Senator Barnes at the hotel. Tell him it's imperative that he come here at once, but you can't tell him why. Insist."

This wasn't the way our first contact with sentient aliens was supposed to go. And it was more than I wanted to handle. I would be overjoyed to turn the glory—and the headaches—over to someone else. Senator Barnes was handy. I offered up a silent prayer of thanks for that.

"This is going to get hectic in a hurry," I said after Diane left. "By the way, what is your name?"

The ape-bear bared his teeth in what might have been his version of a laugh. "It translates as something like Goldie."

"Well, Goldie, life is going to get complicated now that you have, ah, revealed yourself. We'll make other living arrangements for you and your mates immediately, of course. Then you'll have several million people wanting to talk with you."

"It is inevitable," he conceded. "We have known that this time must come, sooner or later."

"If you hadn't made a . . . mistake, how long would you have waited before letting us know?" I asked.

Goldie bared his teeth again. "We have debated that among ourselves," he said. "We thought there was no hurry. Our conditions were not unbearable, and we had some doubt about what would follow when we made ourselves known."

"There's one thing I've got to ask before the rest of the world finds out about you. Two things. The flying lizard in the enclosure across from yours—how did it die? And the animal whose remains we found in the tunnels between buildings—was that your doing?"

"The mergariyes, the creature across from us, panicked when I went looking for its eggs. The other animal . . . well, the food you served us lacked taste. I needed a change. I should apologize for that. It was wrong of me, but the temptation was too great."

Diane knocked once before she opened the door and stuck her head back in the office. "Senator Barnes and his party have already left for Washington."

That's how I came to be the face on the evening news, making the announcement that we had contacted sentient aliens. I guess those are the breaks. I wasn't going to be able to pass the headaches off that easily.■

Habit is habit and not to be flung out of the window by any man, but coaxed downstairs a step at a time.

—Mark Twain

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THE GIZA POWERPLANT

By the time this column comes out, it will have been two years since the appearance of my science fact article "Paradigm Shifty Things" (PST) in the June, 1997 *Analog*. In that article I talked about the work of several researchers that I felt would help to alter the current ruling paradigms in several different disciplines. One of the people I mentioned was Christopher Dunn and his work with what seem to be obvious machine marks on ancient Egyptian stone artifacts. Since then, Dunn has achieved a rather high profile in the field of "alternate Egyptology" and has written a book called *The Giza Power Plant: Technologies of Ancient Egypt* (Bear and Company, 1998).

Before getting to a discussion of the book, let's take a little mental excursion.

Imagine that sometime in the future we discover the remnants of a long departed, technologically savvy, civilization. We find their collapsed buildings everywhere. One can barely overturn a single spade-full of earth without finding their tell-tales. On exposed walls are glyphs; in tombs are buried intricately carved statues. Their architecture is mind-boggling—one can scarcely imagine our own civilization erecting such massive, cyclopean works. And yet, when we examine these buildings closely, we find them to have been executed with a precision seldom, if ever, matched back home. Imagine the dust swirling amongst the exposed columns, swirling as it has done for millennia. You stand amongst the ruins and wonder what sort of help you'll need to investigate this civilization fully.

Archeologists, of course. But then there are those buildings. Maybe a few architects, and a civil engineer. The buildings may be in alignment with the stars. Perhaps an astronomer will come in handy. Some of the implements are so uniform and perfect—clearly, these things were manufactured in some way. A machinist, someone skilled in the arts of manufacturing techniques should be brought along. And surely, this mighty civilization wasn't *started* in a desert. Let's also include a climatologist.

This kind of thinking could go on for quite some time. You wouldn't want to leave any stones unturned when it comes to assembling your team. Too few of the right specialists might skew your understanding of this civilization completely.

Suppose at this point in the discussion we switch the civilization in question away from some distant planet to the Sahara, to the civilization of ancient Egypt. Not the Egypt of *The Ten Commandments*, mind you—no, that one is too recent. I'm talking about the First Kingdom, the Fourth Dynasty, pyramid-building era—almost as far removed from Rameses and Moses as we are from the fall of the Roman Empire. When one looks, one finds there an alien civilization in many respects. Apart from their buildings and artworks, little survives from that era. The Fifth Dynasty tombs are covered in hieroglyphs; the pyramids are largely inornate. (For the purpose of this essay, when I say "pyramids," I mean the three monsters at Giza, the largest of these being the Great Pyramid, which is "the" pyramid as far as most people are concerned.)

Now as everyone "knows," Cheops built the Great Pyramid as a tomb. What hardly anyone knows is that apart from his pyramid, the only other artifact we have of Cheops is a tiny statue. As it says in *A History of Ancient Egypt* by Nicolas

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Grimal: "Considering that (Cheops') tomb was the largest monument in Egypt and one of the Seven Wonders of the World, it is ironic that the only surviving sculpture of Cheops is a tiny ivory statuette (9 cm high), which shows him seated on a cubic throne. . . ." Do we have a mummy? No. No mummies have ever been found in the Great Pyramid, and there is no hard evidence at all that the "sarcophagus" in the King's chamber of the Great Pyramid is any such thing. Did grave robbers clean out the treasures of the Pyramid? This theory is thin at best—we do know when the Great Pyramid was first broken into—around 820 A.D. by Caliph Al Mamun, looking for treasure. He didn't find any, nor did he find evidence that anyone else had ever broken in, either.

Let's return to Grimal's words: ". . . it is *ironic* . . ."

Ironic my right eye! It's ridiculous! The Great Pyramid wasn't just the largest building in Egypt. Until recently, it was the largest building on the planet (unless some of those big pyramids in central China are older—we know little about them in the West). Perhaps it would make more sense to reconsider both the tomb theory of the Great Pyramid, and the entire Cheops connection.

This latter thing Chris Dunn doesn't waste time with in his book. Attribute the Pyramid to whomever you wish (except for ancient astronauts—that idea doesn't fly any better with him than it does with me). Date it to any time period you want—the most recent and generally accepted date is between 4,500 and 5,000 years old (and the oldest date goes back to over 70,000 years ago). Dunn is only interested in what the Great Pyramid was actually supposed to *do*.

Of course, the title gives it away. Chris Dunn presents his technologically circumstantial case that the Great Pyramid at Giza was built as a power plant; a coupled oscillator attached to the Earth, endlessly drawing out geomechanical energy for the really ancient Egyptian civilization. But I'm not going to give away the details. It all fits together and it doesn't require any magic, and Dunn himself doesn't demand that you believe his suggestions every step of the way. You don't even have to suspend disbelief—you only have to be willing to accept that what he comes up with is logically consistent with what's known and at least possible.

Dunn's original *Analog* article dealt specifically with ancient Egyptian artifacts that showed signs of having been machined rather than carved. The reason Dunn noticed these things and most Egyptologists had not (though the great Flinders Petrie had himself pointed out some of these anomalies) was because Dunn is a technologist, familiar with machine tools and the characteristic marks they make.

One odd thing Dunn had found in the writing of Petrie was a sort of bore hole, in granite, that showed evidence of having been drilled out at a rate impossible to do in modern times with anything other than an ultrasonic drill. For that matter, the bore itself had the characteristic outlines of a hole drilled via that very method. The obvious criticism is that the Egyptians did not have electrical power technology. Dunn's book explains how it is possible that they actually did.

Shades of *Chariots of the Gods*? Afraid not. If your own interests lie that way, then this isn't the book for you. Dunn looks at the Great Pyramid the same way some future civil engineer or power engineer might look at the remnants of Hoover Dam.

Perhaps some of you are wondering whether or not I think Dunn's hypothesis is right. Nope. But I don't think it's *wrong* either. I think it's high time alternative ideas about the nature and potential *function* of the Great Pyramid got an honest hearing. For crying out loud, if there's anything on the face of the Earth that counts as an honest-to-God archeological enigma, as an anomaly to beat all anomalies, it's the Great Pyramid. Her scale, her precision of execution, her uncanny resonant characteristics—she is underappreciated by establishment Egyptologists because she's been around forever.

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How long would it take to quarry the stone used in the Great Pyramid? Ask a modern day quarryman. I don't think any Ph.D. Egyptologist ever has; though some amateurs have. The Great Pyramid is supposed to have been built in about 20 years. But if the current Indian limestone industry were to triple its output from its 33 quarries, and even using modern-day equipment to cut, lift, and transport the stone, it would still take 27 years to fill an order for the 131,467,940 cubic feet of stone required to build the Pyramid, and that's assuming no downtime from accidents, acts-of-God, and the usual inevitable delays.

Chris Dunn published his first ideas about Egyptian manufacturing techniques right here in *Analog* in 1984 (he thanks Arlan Andrews, Stan Schmidt, and me on the acknowledgments page—a true *Analog* connection here!). In 1995 he was able to return to Egypt as part of a TV special and do some interesting on site inspections.

If you are told that something is flat, like a table or a wall, what does that really mean to you? How flat is flat? Take something that you know is genuinely flat, like the edge of a quality straightedge, and put it against a wall or a door. If need be, put a flashlight behind it. Know what you'll see? Gaps. When you put something really flat against something only sort of flat, it is easy to see that most of the things in life that we think of as flat really aren't. No, real flatness is something not all that easy to achieve. It takes really good machining to do it, particularly over large surfaces.

I bring this up because I want to leave you with the one thing I find the most jaw-droppingly perplexing thing in Dunn's book, the dead give-away that the ancient Egyptians must have been far more technically savvy than we've ever given them credit for.

On page 94 of the book Dunn describes his little expedition to the second huge pyramid on the Giza plateau. The King's chamber of the Great Pyramid being overly crowded with tourists, Dunn decided to inspect the "sarcophagus" in this other pyramid. It's nearly as large as the Great Pyramid, but the internal chambers are different.

On this trip to Egypt Dunn had brought along several tools. One of these was something called a "parallel"—a flat piece of steel six inches long and one-quarter-inch thick, the edges ground flat to within .0002 inches. This is a "flat thing" indeed. Dunn hopped inside the sarcophagus and applied the parallel to the interior sides of the box. The walls were flat. He took a flashlight and shown it behind the parallel looking for gaps. He moved the parallel all over the walls, looking for deviations from this total flatness, but he couldn't find any.

Now, we're not talking about something flat over an expanse of only a few inches—we're talking about flatness, of a granite surface, on the interior of a one-piece box, over an expanse of *feet*!

This is not the sort of precision achievable with copper chisels, nor with cracking rocks against each other. It's also not the sort of thing one achieves by hand even if one devotes his life to it, for what do you use to make sure your surface is, in fact, precise to such tolerances?

This ain't the sort of thing you can eyeball.

Many *Analog* readers are interested in archeological anomalies. But most of us aren't too willing to jump into the ancient astronaut camp. Yet, to find out about the anomalies that interest us, we're forced to wade through the "ancient astronauts" stuff since the conventional literature doesn't spend much time dwelling on those things it can't explain, or that it has already explained away in the past. Dunn's book is a welcome change from this since the focus is narrow enough (on technology and just Egypt) and he stays close to his own area of expertise. Most importantly, he's perfectly willing to admit he may be entirely all wet. In short, this is the sort of weird archaeology book one would expect to be produced by an *Analog* reader. □

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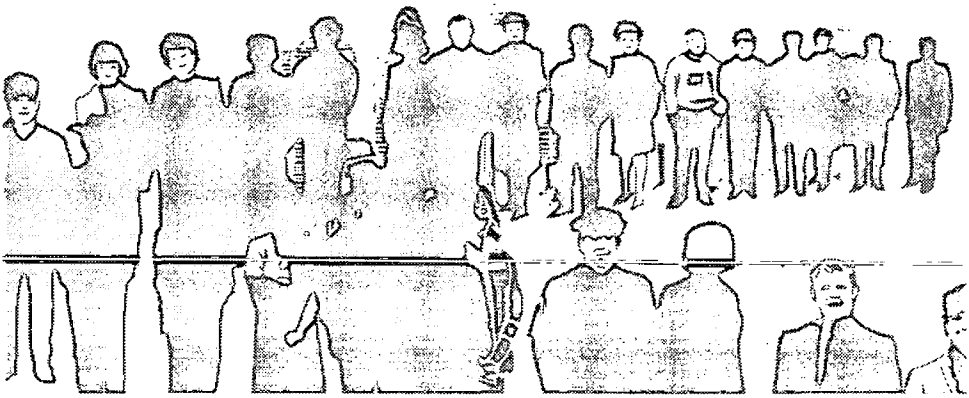
F. Gwynplaine MacIntyre

TIME LINES

There are those who, when thwarted in their original intents, excel at turning problems into opportunities. . . .



When Smedley Faversham discovered the secret of time-travel, he immediately decided to go back in time and kill Hitler.

This single act would alter history forever. World War Two would never take place. Millions of innocent human lives would be saved.

Smedley Faversham was no fool, and he saw at once the danger of his plan. He must not go rushing blindly yesterwards, changing the past willy-nilly. If Smedley Faversham killed Hitler at the *wrong* point in space-time, history might proceed along an alternate timeline that was actually *worse*, not better, than the one in which Hitler had lived. Smedley would have to do his homework. He jotted a simple memorandum in his datebook ("KILL HITLER," neatly lettered on a blank page underneath the heading *Things to Do Today*), and then he searched for the ideal nexus of space-time in which to perform the grim deed.

It would hardly do, Smedley thought, to kill Hitler in Berlin in 1933—at a point in the timeline when he was already Chancellor of Germany, and had much popular support. "If I kill Hitler in 1933, one of his followers will take his place—and the timeline will not change significantly," Smedley theorized. "So I'll just have to kill Hitler *before* that point. I must go farther back in time."

Yes, but *when?* Smedley rejected the notion of killing Hitler at the moment of his birth in Austro-Hungary in 1889. A newborn baby—even a baby who was destined to invade Poland—had committed no crime punishable by death. Nor could Smedley bring himself to do the deed at any point in the timeline during Hitler's boyhood in Linz.

"I must kill the man who committed the supreme evil, not the innocent child who *became* that man," Smedley vowed. "But in order to alter the timeline, and save humanity from Hitler's evil, I must kill him *before* he does anything particularly evil."

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Clearly, the challenge was this: Smedley would have to find the precise moment in history when Hitler had achieved the maximum degree of villainy for the smallest amount of actual harm to humanity. Smedley conducted his research with care, and he decided that the best nexus in space-time for killing Hitler was located in Munich on September 12, 1919. This was when Hitler infiltrated the German Workers' Party, with the specific intention of subverting it to his National Socialist agenda.

"Perfect!" said Smedley Faversham. "At this point in the timeline, Hitler has already formed his ambitions—but he has not yet acquired any followers. If Hitler dies in 1919, then *I*—Smedley Faversham—will have changed the course of history!"

And so it was done. Smedley Faversham obtained a handgun and some bullets, and—after checking off the entry "KILL HITLER" on his list of *Things to Do Today*—he traveled yesterwards, against the current of the time-stream, to his moment of destiny.

When Smedley Faversham traveled back in time to Munich in 1919, the first thing he saw was a large sign reading "THIS WAY TO KILL HITLER." Underneath the sign were several hundred people carrying assorted weapons. The people stood in a neat line between two sets of those red velvet ropes like you see in banks and post offices, and at the end of the line there was one of those take-a-number machines.

"What the hell is this?" complained Smedley.

Just then Smedley was approached by an astonishingly handsome man and an unspeakably beautiful woman. The man and woman wore tailored black uniforms of some unknown material that covered but did not conceal their magnificent physiques. On the left side of their respective chests, the man and woman each wore a small silver emblem shaped like a balance scale (representing the scales of Justice) superimposed across an hourglass (symbolizing the sands of Time). Smedley had never seen this emblem before, but he knew instantly that these people must be Time Cops.

"Welcome to 1919," said the astonishingly handsome male Time Cop. He glanced at the handgun jutting from a holster on Smedley's belt. "You must be here to kill Hitler. You'll have to get in line."

The unspeakably beautiful female Time Cop gestured towards the hundreds of armed assassins who were lined up patiently outside the German Workers' Party headquarters. "All these other people came here from the future to kill Hitler too," she told Smedley. "Please stay in line and wait until your number is called."

Smedley stared at the *very* long line of time-travelers. Some of the more conscientious ones—apparently hoping to blend into this time-period, and wishing to cause as little paradox as possible—had taken the trouble to disguise themselves in replications of the clothing worn in Munich in 1919. Their weapons were careful replicas of firearms dating from this era. But most of the time-travelers didn't seem to give a hoot for historical accuracy. They were dressed in futuristic outfits and they carried ray-guns, photon blasters, neutrino bombs, and other weapons highly inappropriate to this region of space-time.

"Wait a minute," Smedley said to the Time Cops. "You mean that *all* of these people are waiting for a chance to kill Hitler? But surely only one of them can succeed."

The female Time Cop shook her head. "They'll *all* get their chance to kill Hitler. You'll get your chance too, sir. But you must wait in line."

At that moment, a gunshot rang out from within the German Workers' Party headquarters. The door opened and a woman emerged, cheerfully blowing

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smoke from the barrel of a Webley-Vickers cavalry pistol. "*Next!*" she called out, and the entire line of time-traveling assassins moved forward one place.

"But surely, if *one* person kills Hitler, then the timeline has been permanently altered, yes?" asked Smedley.

"You must be one of the very earliest time-travelers," said the astonishingly handsome male Time Cop. "Obviously, you're unfamiliar with Bester's Law."

"*Who?*"

"Named for Alfred Bester, the first person to formulate it," said the unspeakably beautiful female Time Cop. "Bester predicted that people who alter the time-stream can only change the events within their *own* timeline; never anybody else's. Not even Hitler's."

"And so you're here to enforce Bester's Law?" Smedley Faversham sneered at the pair of Time Cops. "What does that make you two, then: the Bester-Boosters? The Bester-Busters?"

The female Time Cop adjusted the tight-fitting bodice of her uniform—Smedley assumed that she had encased her bust in an official Bester-Buster *bustier*—while she shook her head. "No, we're the Paradox Patrol," she told Smedley.

"At your service, sir," said the male officer, and saluted. "But you'll still have to get in line if you want to kill Hitler."

Smedley Faversham pondered this concept while he took another look at the very, *very* long line of Hitler-killers who were here ahead of him. During the last few seconds, at least a dozen other time-travelers had materialized from various centuries and were taking their places in the line—*ahead* of Smedley, who had staunchly refused to accept a number from the take-a-number machine.

"Now hold on," said Smedley to the two Paradox Patrol officers. "You mean to say that—if I kill Hitler in the past, and then return to my own time—it won't make any difference *at all?* But then why are all these people lining up to do it?"

The male chrono-constable shrugged. "Maybe they just like killing Hitler. Some people collect stamps, other people travel back in time to kill Hitler." As he spoke, the Paradox Patrolman nodded courteously to a man—completely bald, and stark naked except for a glittering loincloth—who had just joined the line, clutching a bizarre apparatus that was clearly some sort of death-ray projector. "That fellow there, see him?" the male Time Cop continued. "He's repeat business. Every time he can spare a few minutes away from his native century, he comes back to 1919 and kills Hitler. Must be his hobby, I guess. I've seen him standing in this line eight or nine times already. Once he even brought along his own closed-causality loop, making time repeat endlessly. He had to stand in line behind *himself*"

"And I've seen that same time-traveler in 1912, on the deck of the *Titanic*," said the Paradox Patrolwoman. "Before I was assigned to this Hitler gig, I used to walk a beat on the *Titanic*." She shivered at the memory. "*Brrrr!* Now *that* was a cold job! And wet, too! I had to put in for a transfer."

Suddenly there was an ear-splitting explosion, and a gust of wind, as the German Workers' Party headquarters dissolved in the eerie glow of a mushroom cloud. Smedley shielded his face, and closed his eyes. When the noise subsided he opened his eyes, expecting to see a smoldering crater where the party headquarters had been.

The building was intact. So was the long line of potential Hitler-killers. "*Next!*" someone shouted, and the line to kill Hitler moved forward.

For a moment, Smedley Faversham considered returning to his own time-period without killing Hitler at all. On second thought, *no*: he had come this far to kill Hitler, and kill Hitler he *would*. Yet it seemed grossly unfair that he should have to wait in line.

"You should let me go ahead of all

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these others," Smedley told the Paradox Patrol officers. "After all, I'm the very first person who discovered how to travel through time."

"They all say that, sir," said the male cop indulgently.

"Just a minute." The female Paradox officer took out a gizmo resembling a pocket calculator. She touched several buttons, then consulted the readout. "Holy tachyons! He's right!" She looked at Smedley Faversham with an expression of newfound respect. "Congratulations, sir. Our records show that you are indeed the very first person in the timeline who has ever traveled *outside* the timeline."

"Of course I am," said Smedley Faversham. "But since I'm the *first* person to travel into the past, then how did all these *other* time-travelers get here ahead of me?"

The two Time Cops exchanged glances. "He really is a time-rookie," said the woman to the man.

"It's very simple, sir," the male cop told Smedley. "All these other time-travelers originated at points *after* you in the timeline—they came from what you would consider *the future*—but they all traveled yesterwards to an *earlier* point in the timeline than the destination which *you* chose. In other words, they all got here before you."

"I see," said Smedley Faversham. "Well, thank you very much."

Then Smedley drew forth his handgun and shot both Time Cops dead. He snatched the timeline gizmo from the female officer, and then he went home to his correct point in space-time.

Smedley Faversham was not a man to give up easily. He analyzed the stolen gizmo and learned how it worked. By inputting the proper commands, he could access the temporal trajectory of any person who had ever lived or who ever *would* live, in the past or the future. Each individual life—every thread in the loom of humanity—could be charted as a precise set of coordinates within the fabric of space-time.

As soon as he understood this cosmic truth, Smedley Faversham went to a gun shop and bought lots of ammunition.

With the stolen gizmo to guide his course, Smedley traveled ahead in time: forwardly futuring. He went morrowing, moving ahead of the time-stream beyond his own era. Searching the future, he located each of the hundreds of time-travelers who had lined up ahead of him to kill Hitler. One by one, Smedley stalked them through time's corridors, and he blew their heads off. He was careful to kill each time-traveler *before* the momentous instant when that particular person discovered the secret of time travel.

When he had eliminated all of his competition, Smedley Faversham reloaded his handgun and went back—one more time—to Munich in 1919.

This time there was no waiting in line. Smedley walked right into the German Workers' Party headquarters like he owned the place. "Which one of you guys is Hitler?" Smedley demanded.

"*Ich bin*," said a thirtyish man with an Austrian accent, who indeed looked like a youngish version of Hitler.

"Let's see some I.D.," said Smedley Faversham.

The thirtyish Austrian produced an identity card bearing the name HITLER in large red letters of Fraktur typescript.

"That's all I wanted to know," said Smedley Faversham, and blew the top of Hitler's noggin off before the future Führer could so much as twitch his mustache. Hitler fell, writhing in agony on the carpet. "*Ach du lieber!*" said Hitler, through a mouthful of rug. And then he died.

"Now that's more like it," said Smedley. "I really *hate* waiting in line."

But Smedley's task was not yet finished. A less methodical man might have altered the past without recognizing the consequences of his actions. Not Smedley Faversham. He had murdered, at

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conservative estimate, 837 distinct and separate Hitler-hunters across a span of twelve millennia. And Smedley Faversham was determined to escape punishment.

So Smedley morrowed futurewards one more time, using the stolen gizmo to locate the precise instant in space-time when the Paradox Patrol was created. If Smedley Faversham could change the future *before it happened*, he could nullify the existence of the only law-enforcement agency capable of punishing him for his time-space misdeeds.

Sure enough, Smedley found himself inside a twenty-seventh-century edifice. Dozens of black-uniformed men and women, each with one hand solemnly upraised, were pledging their oath of loyalty to the Paradox Patrol. At the center of the group, Smedley recognized two officers: an astonishingly handsome man and an unspeakably beautiful woman.

By now, however, Smedley knew how time travel worked. "I murdered those two Time Cops in *the past*, in 1919, but they're still alive at this point in the future," he observed. "Evidently, they have not yet reached that moment in the timeline when they *will* travel back to 1919 and meet their deaths. Therefore they haven't met me yet, and so they won't recognize me."

Just as Smedley thought of this, the female Time Cop turned and saw him. "Hey, everybody! Look who's here!" she said. "It's Smedley Faversham!"

"How did you recognize me?" Smedley asked. "I haven't killed you yet. I mean, actually I killed you seven centuries ago, in 1919, but it hasn't happened yet."

The male Paradox officer took out a small gizmo which looked exactly like the one Smedley had stolen from the female officer. "We can chart the whole timeline, of course," he told Smedley, while he tapped a few buttons. "Our records confirm that you murdered us in 1919. *Tsk, tsk, tsk*. Shame on you."

Smedley drew his pistol, and backed up against the nearest wall. "You'll never take me alive, coppers—in *this* century, or any other. I've killed you once, and I won't hesitate to kill you again."

None of the Paradox Patrol officers moved. For a moment, Smedley thought that they were paralyzed with fear. Then one of the men yawned, as if this sort of thing had happened many times before.

"You want to kill us?" asked the Paradox Patrolman who had yawned. He was perhaps a single increment less good-looking than the other officers. "Go ahead! Kill us all! It won't alter the time-stream. Thanks to Bester's Law, you'll only change your *own* timeline. Not ours. We'll be simultaneously alive *and* dead—which you'd already know, if you had ever bothered reading any Schrödinger."

Smedley saw that he had lost. He meekly offered his weapon to the nearest officer. "OK, I give up. I guess you want to put me on trial for mass murder."

"What for?" asked the unspeakably beautiful Paradox Patrolwoman. "You gunned us down in cold blood, and then you slaughtered hundreds of innocent people throughout the time-stream, but there's no hard feelings. Nothing you did makes any difference. The stream of time flows on, as it always has and always will."

"You couldn't alter time if you *wanted* to," another officer sneered at Smedley. "Beat it, time-punk."

"Come again any time," said a patrolwoman. "Kill us as often as you want. Just don't expect it to change anything."

"Wait a minute." Smedley holstered his pistol. "You mean to say that I came all this way uptime—"

"Downtime, not uptime," the unspeakably beautiful Paradox Patrolwoman corrected him. "All you time-rookies make that mistake. The time-stream is like a river; the current flows one way only. If you travel into the past—upstream, *against* the current of time—then you're traveling uptime. If

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you travel into the future—in the same direction as the current of time, only faster—then you're moving downtime. Get it right, please—and when you return to your own time-period, please explain it to the science-fiction writers. The ones in *your* century were particularly ignorant, for some reason."

"I'm free to go?" asked Smedley Faversham. "After all those murders I committed, I'm not under arrest? You won't put me on trial?"

"We never arrest anybody," said one of the Paradox Patrol officers. "And we always let time-tourists commit all the time-crimes they want. Bester's Law guarantees that chrono-criminals can't damage anyone's timeline but their own."

"But if you don't make arrests, and if you don't prevent crimes," said Smedley Faversham, "then why bother patrolling the time-stream at all? What are you cops *for?*"

"Crowd control, of course," said the astonishingly handsome Paradox Patrolman. "Some points in space-time are so popular that *every* time-tourist wants to visit them—and sometimes more than once. It's our duty to keep back the crowds, and make sure they proceed in an orderly fashion."

"Oh, now I get it," said Smedley Faversham, and returned to his own time. Just before he left the twenty-seventh century, he toyed with the notion of gunning down every member of the Paradox Patrol.

Not that it would make any difference, of course.

When Smedley Faversham comprehended the immutable concept of time travel, he decided to make a fast buck out of it.

He promptly set up souvenir stands at all the most popular junctures of space-time, hawking postcards and keepsakes and merchandise emblazoned with tasteful phrases such as "MY PARENTS WENT BACK IN TIME TO WITNESS THE CRUCIFIXION AND RESURRECTION OF CHRIST, AND ALL I GOT WAS THIS LOUSY T-SHIRT".

Each one of Smedley's souvenir stands offers merchandise to fit the individual occasion. For example, his souvenir stand in 1865—located in Ford's Theater during the last performance of *Our American Cousin*—sells playbills and opera glasses, so that time-travelers who can't get near the Presidential box can still watch from a distance while Lincoln gets assassinated. Smedley's souvenir stand in 1963—conveniently located at Dealey Plaza in Dallas—sells binoculars and pennants, and offers a wide range of refreshments for the time-tourists who came to witness the Kennedy assassination. (By the way, there is *no* possibility that any shots were fired from the grassy knoll. That's because Smedley's souvenir stand is *on* the grassy knoll, and it takes up all of the available space.)

Smedley proved that it *is* possible to change the past. When he set up his concession booth on the deck of the *Titanic* in 1912, Smedley managed to send a warning to Captain Smith just in time. Disaster was averted, and the *Titanic* avoided the iceberg with inches to spare. Unfortunately, so many thousands of time-travelers had materialized on the decks of the *Titanic* that the ship sank anyway, under their excess tonnage. No problem; Smedley rents lifeboats.

Choose any noteworthy location in space-time, and you may be certain that Smedley Faversham has set up one of his souvenir stands there. Besides selling souvenirs and refreshments, he also sells phrasebooks—offering the local slang and dialect of each time-period—so that time-tourists can communicate with the natives. For time-tourists who want to go native—and who are willing to pay the extra expense—Smedley offers the sale or rental of clothes guaranteed to blend in with the local era and culture.

Whether you visit ancient Crete, pre-Columbian Peru, or Tudor England, Smedley Faversham is there. He cheer-

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fully accepts payment in your choice of currencies: either the money of your native century, or the money of the space-time nexus which you're visiting. There are, of course, a few currencies which Smedley refuses to accept: during his visit to Munich in post-war 1919, Smedley observed that the locals were paying a *billion* deutschemarks for a loaf of bread. If a visit to this era is on your itinerary, bring time-travelers' checks. And forget about credit cards. Smedley doesn't take plastic. The hassle involved in billing a customer's home address in 2975 A.D. for a toga rental in 44 B.C.—especially with the monthly interest rates compounded over three millennia—just isn't worth it. Leave your credit cards home.

By now, Smedley Faversham's chain of gift shops and souvenir stands has grown well into the millions, catering to visitors in every era from the Jurassic Period to World War Nineteen. And Smedley does all the work himself, to save expenses. You may wonder how Smedley Faversham can operate souvenir stands in millions of different eras, all at the same time. He doesn't. He operates them all at *different* times, simultaneously.

Smedley Faversham is now very, very, *very* rich. Although he cannot change the fundamental time-stream, he has still managed to prosper from the time lines—from the *lines*, that is, formed by the millions of time-travel tourists who trudge past his souvenir stands.

Once in a while, a time-tourist will make some envious remark. As they buy their souvenirs from him, and Smedley's profits increase even further, every so often a few disgruntled time-trippers will comment that *they* could have cashed in on this idea first, if only they had thought of it before Smedley did. And every once in so often—usually with a smile and a joke, but sometimes with malice and genuine envy—an occasional time-tourist will comment that he or she ought to travel yesterwards or go futuring to a point in space-time *before* Smedley had the idea of creating time-tourist souvenir stands—so that they could kill him, and steal his idea.

"*That* way," the various time-tourists always tell Smedley, "I can have your idea *ahead* of you. And then *I'll* be the one to get rich."

Whenever anybody says this, Smedley just smiles and tells them: "Go ahead and try it."

And then he sells them a bumper sticker. ■

MOVING?

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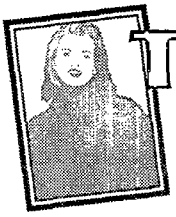

THE KARMA SUTRA

Don D'Ammassa

The trouble started when someone invented a device that eavesdropped on the collective subconscious of the human race, although Paul Alford didn't make the connection until the night his dream was interrupted.

He had gone to bed early after returning from the holotheater where he'd thoroughly enjoyed Winona Bullock's scanty costuming in *Terminator 12*, and he was slipping into an unimaginative but satisfying wish-fulfillment dream in which the beautiful time traveler rewarded him for his assistance by spending the night with him. She approached the bed, smiling broadly, and reached behind her back to unsnap the translucent halter top.

And froze in place.

A serious-looking man in a retro haircut entered the room.

"Mr. Alford, are you aware of the fact that you are violating copyright?"

The dream Paul blinked and the real eye quivered in sympathy. "I have no idea what you're talking about."

"I am a recorded karma applet created by Norris Promotions, Inc. Under the Protection of Personal Resources provision of last year's Uniform Copyright Reform Act, you are prohibited from using the likeness of my client, to wit Winona Bullock, in any waking or sleeping dream unless you have previously paid the appropriate royalty."

"Royalty?"

"That's correct. We offer a wide variety of licenses, ranging from single-night cameo appearances through unlimited use for pre-arranged periods of time. Ms Bullock offers participation up to and including several variations of conventional sex, although anything kinky is specifically prohibited."

"How much would it cost me for, umm, a one-night stand. Simple sex, maybe a little bit of adventure in between sessions to keep things interesting."

The dream agent quoted a figure.

"No way. I could buy a copy of the holo for that."

"That is your prerogative. Our prices, however, are non-negotiable." He blinked out and, a moment later, so did the now inanimate actress.

Paul's subconscious was easily imprinted, and the following evening he studied a picture of Uma Pfeiffer before bedtime. His dreams that evening were entirely satisfactory, a situation that continued until the weekend, when a portly, red-haired man interrupted a dream to inform him that Ms. Pfeiffer was now a client of his agency. By the end of the month, all of his favorite celebrities were off limits, and thirty days after that, he was having trouble finding bit players who hadn't signed up for Protection of Personal Resources.

Although it was less satisfactory, he was forced to resort to dreaming about people he actually knew, Dolores Cortiz down at the bank, Sarah Ames from the gymnasium, and when he was desperate for variation, Carla Scott, his slightly overweight neighbor. From time to time he was tempted to shell out the credit for a night with Goldie Streep or anoth-

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er of the less expensive stars, but his budget was tight at the best of times, and in any case he didn't like the idea of paying for sex, even dream sex.

On the first day of summer, Paul had just set the scene for a romantic interlude with Sarah Ames when a short-haired woman with a stern expression materialized in the middle of the prison camp where he was planning an elaborate rescue. "I am here to inform you that my client, Sarah Janes Ames, has registered under the Protection of Personal Resources clause, which precludes use of her likeness without prior written permission."

Dolores Cortiz and even Carla Scott had signed on within the month.

Paul's subconscious tried to improvise for the next several weeks, creating imaginary women out of bits and pieces of memory. Sometimes it worked, but more often his creations would slowly assume the attributes of a single real person, at which point the automatic dream agent would appear, often interrupting at the most inauspicious moment.

Paul had nearly reached the point where he dreaded sleep and the frustrations that would accompany his dreaming when the pirate appeared.

He had just aborted a pretty good wish-fulfillment sequence in which he rescued an almost recognizable Jennifer Michelle Holmes from a squad of stock Nazi stormtroopers when her dream agent appeared and advised him he was infringing on copyright by dreaming of too close an approximation. Paul was standing in a slowly fading war-torn French countryside, waiting for the dream to fade completely, when an anachronistic pirate, complete with parrot, pegleg, and patch, stepped out from behind a tree.

"Hey, mate. I think I can help you." He winked the one good eye lasciviously.

"Not in your dreams," Paul responded. "And definitely not in mine."

"No, you don't understand me. I mean, I can fix you up with the woman you want."

"Yeah, I've seen the rate schedules. Too rich for my budget."

"There's ways around the rules, mate. You see, when you pay for a license, they let you draw this packet of karma. The karma travels through the collective subconscious. But what they don't want you to know is, there's ways to record a copy of those packets if you have the right equipment. Now I won't lie to you. The copies aren't quite as good as the original. Sometimes the hair color is wrong, or the voice is a little funny, or some other detail gets lost or messed up. But we charge ten percent what the big agencies do, and you only pay once. We tag the packet to your personal subconscious node, and you can draw on it as many times as you want."

Paul thought about it. "I don't know. Isn't this illegal or something?"

"Technically, but why should all these hotshot celebrities and their agents make money because of your dreams? After all, you're doing all the work. You're the creative one. Look, I'll give you our account number. Remember it tomorrow. Think about it and give us a call."

And he did, for almost an hour, then made the call, transferred the credit, and purchased an unregistered karma copy of his first love, Winona Bullock.

That night, Paul could hardly wait to fall asleep. He had done everything he possibly could while conscious to predispose himself to the dream he wanted, and sure enough, he found himself in a lovely southern mansion with his enthusiastic new wife. After some hasty preliminaries, they retired to the bedroom, where she slowly began to disrobe. And sneezed. And sneezed again.

Naked at last, she joined him in bed, her nose bright red and running, eyes watering, and the other symptoms of a bad cold becoming so irritating that at last he rolled away from her in frustration.

It figures, he thought before drifting off into deeper, dreamless sleep. Buy a bootleg copy from a pirate, and you're almost certain to end up with a virus.■

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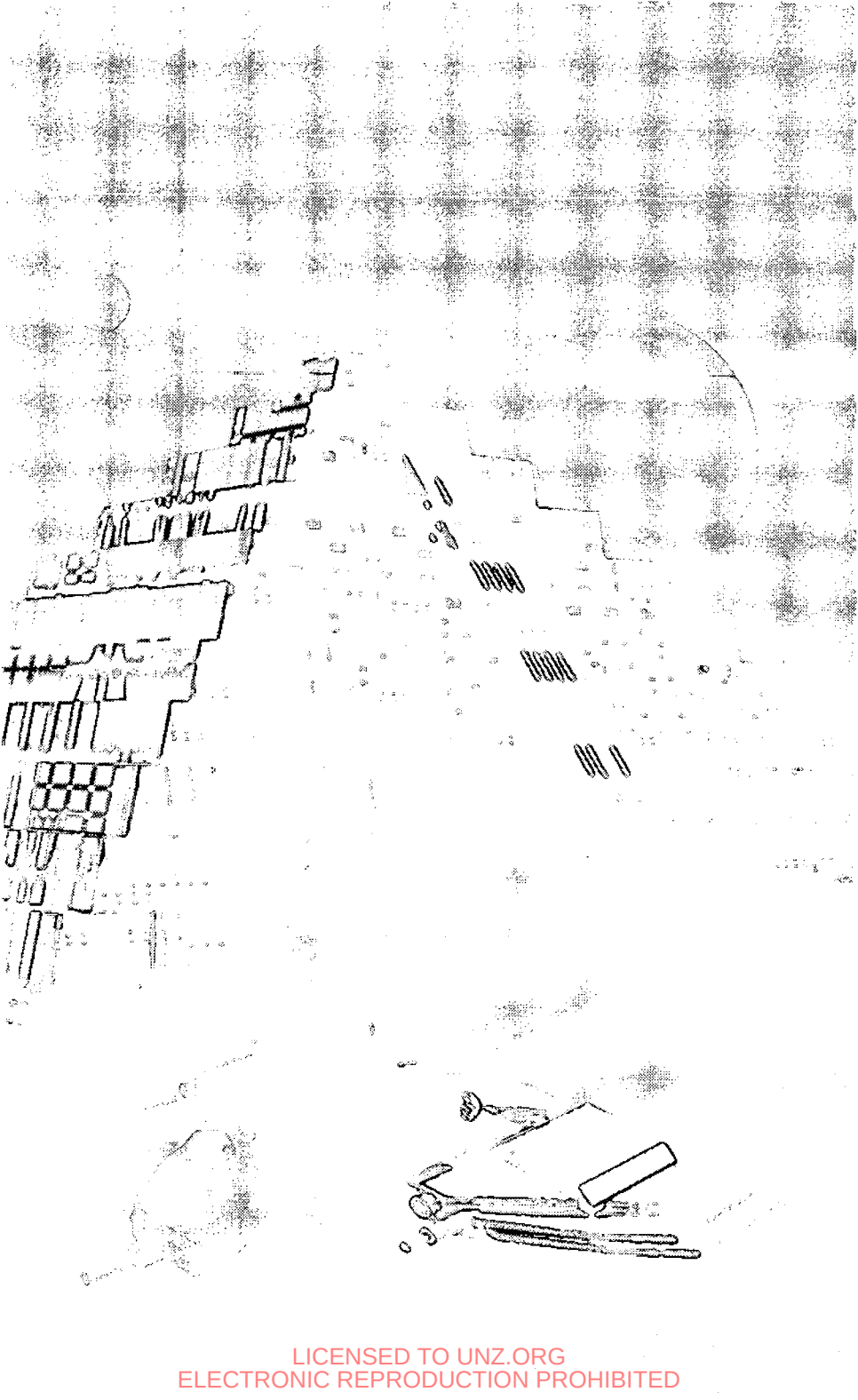

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Part Two of Three

Catherine Asaro

THE QUANTUM ROSE

New forms of knowledge can revive long-buried institutions in chilling new forms. . . .

Illustration by George Krauter

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Synopsis of Part I

Kamoj Quanta Argali *is a young leader on the planet Balumil, a world of excruciating climate extremes and worn-out land. Its sixty-hour days, long year, blue-white sun, and scaled life all make Kamoj feel oddly out of place, though she can't explain why. Balumil is the only world she has ever known.*

Over the millennia her people have lost their knowledge, their machines, and the history of their origins. They no longer understand even their names; no one knows why Kamoj's bodyguard is named Light Emitting Diode, *so they simply call her* ***Lyode.*** *Although one scholar claims the translation of Kamoj's name is* Bound Quantum Resonance, *Kamoj and everyone else believe it means* rose.

Kamoj is the hereditary governor of Argali Province. Knowing her impoverished province is dying, she has established a merger with the flourishing Ironbridge Province, governed by ***Jax Ironbridge.*** *Their agreement is both a business arrangement and a betrothal.*

Jax is one of the rare humans on Balimul who experienced an extended childhood. He reached his adulthood years later than his contemporaries, but by the time he did, he was taller, stronger, and more intelligent than everyone else. He is one of the few people who can read and write. He is a strong leader who inspires respect, but he is also known for his violent rages.

Argali has a mysterious guest, ***Havyrl Lionstar*** *(Vyrl), the brooding governor of Lionstar Province, a place no one has ever seen. No one knows what Vyrl looks like: he always wears a cloak with a cowl hiding his face. For about one hundred days he has "rented" the ruins of the Quartz palace, the ancestral home of Kamoj's family. Myths surround him; the villagers believe he is hundreds of years old, grotesque, sorcerous, and cursed.*

After seeing Kamoj swimming in a river, Vyrl disrupts the entire political situation in her lands by sending her an immense "dowry." In the laws of her people, he has done the equivalent of a hostile take-over bid in the "corporate" negotiations she had been conducting with Ironbridge.

Forced into a sudden marriage with Vyrl, Kamoj learns he comes from off-world, but she doesn't understand what that means. Nor does Vyrl realize the cultural implications of his actions; he believes Kamoj came to him of her own free will. His history-changing bid for her province was, incredibly, the result of a drinking binge. But beneath his troubled exterior, he is a gentle man with a deep sense of honor and decency.

At first Kamoj thinks Vyrl has a metal face. Then she discovers it is a mask, one that helps him breathe. Without it, he would die. Far from seeing him as grotesque, she finds him beautiful—but strange. Beneath his mask, his hair and eyelashes also have an odd metallic cast. Even stranger, his eyes have round pupils. Her people have slits for pupils.

Kamoj also meets ***Colonel Dazza Pacal.*** *Both Dazza and Vyrl are much taller than Kamoj's people, speak an odd dialect of her language, and talk about things she doesn't understand—sciences, technologies, and places unfamiliar to her. Vyrl tells Kamoj that Dazza is his doctor, but he doesn't explain why he needs a healer nor why it is someone of Dazza's obviously high rank.*

Vyrl's people have repaired the crumbling palace, adding technological marvels that stun Kamoj. He has a wealth and power almost beyond her ability to comprehend, yet he seems oblivious to his own prodigious status.

Kamoj and Vyrl respond to each other in a way that surprises Kamoj, though not Vyrl. Due to their genetics, their minds have an unusual neurological resonance that draws them together. She also finds that Vyrl is a kind man,

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far more so than Jax. She is glad for their alliance, both in personal and political terms. However, she fears the abrupt severance of her negotiations with Ironbridge may cause severe political repercussions.

During their wedding night, Kamoj wakes to find Vyrl in the throes of a nightmare. His scream brings his bodyguards, but he sends them away, then retreats into his study. Watching him sit alone in the dark, Kamoj realizes that whatever haunts him goes far deeper than she, Colonel Pacal, or any amount of drinking can help. But she has no idea what could have devastated the life of a man with such strength and power.

Part II

BINGE
Higher Level Eigenstates

Early morning light filled Kamoj's room. Jul had yet to rise above the forest, so no rays slanted in the window, which someone had opened while she slept. She lay alone staring at a tapestry on the wall across from the bed. The hanging depicted two fierce women in warrior garb engaged in a duel over a youth. They were facing off in a forest clearing, one with a bowball cupped in her palm, her arm raised to throw it. Their young man stood leaning against a tree with his muscular arms crossed, looking appropriately dashing. He also looked rather disconcerted, which Kamoj suspected was closer to the truth of whatever legend had inspired the tapestry.

She felt lethargic, unable to face the day. She had watched Vyrl for more than an hour last night, afraid to intrude on his solitude. Exhaustion finally forced her to choose between sleeping on the floor or returning to bed.

Still, lying in bed solved nothing. She got up and went into the main bedroom. It was empty of Vyrl, but two trunks stood against the foot of his bed. Her trunks.

Her mood lightening, she went over to the trunks. The first held her clothes and the second had personal items, including the dolls from her childhood collection. She picked up her favorite rag doll, enjoying the familiar feel of its yarn hair against her cheek.

"Governor Argali?"

Startled, Kamoj looked up. A housemaid stood in the doorway of the entrance foyer. She must have been on the landing outside, waiting for Kamoj to wake up. "I heard you opening the trunks," the woman said. "Would you like help dressing?"

Kamoj reddened, embarrassed to be caught holding a doll. Lowering it, she said, "Not today. But thank you."

"Yes, ma'am." The woman bowed and withdrew.

Putting away her things took several hours. Then Kamoj went to the bathing room. Someone had swept up the glass and opened the window, letting sunshine in and the rum smell out. Bracing herself for icy mountain water, she slid into the pool. What she felt was even more of a shock: warm water. How? She saw no steaming stones or other heat sources.

Then she remembered her heel. Holding onto a claw of the quetzal statue, she pulled her foot out of the water. All she saw was healthy pink skin with a slight bruising. That rapid healing impressed her as much as all the other marvels she had seen here.

After her bath, she ran naked back to her chamber, racing across the main bedroom. She wasn't sure why she ran. Vyrl had seen her without her clothes, and besides he wasn't here. But she ran anyway. For all she knew, Morlin watched everything.

In her room, she started to take out a tunic. Then she changed her mind and put on a rose-cotton farm dress instead. It gave her pleasure to think Vyrl might enjoy how she looked. None of her

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dresses fit anymore, though. Her breasts plumped out the neckline, the waist was too tight, and the skirt barely reached her knees. She pulled up lacy ruffles from her underdress to cover her breasts and tugged her underskirts down until their ruffles swirled around her knees. Then she pulled on grey leggings made from Argali wool, followed by her suede farm boots.

Kamoj left the suite and paused on the landing at the top of the stairs. She was hungry, but she wasn't sure where to find the kitchen. She also had to find Vyrl, to discuss Argali. Theirs was a tricky situation, one with no precedent that she knew. The union of provinces through a dowered merger of two governors was almost unheard of. She and Jax had agreed to split their time between Argali and Ironbridge. With Vyrl she had no idea. He could demand control of Argali or leave it to her, tax her province to death, shower it with riches, ruin it, or ignore it.

She descended the stairs, listening to the forest, the wind in the trees and the blue-tailed quetzals calling, even the trill of a gold-tail. Flaring the membranes in her nostrils, she inhaled the scents of the forest and its scale dust. It wasn't until she reached the bottom that she heard the voices. As she walked down the Long Hall, they resolved into an argument between Vyrl and Dazza.

"I can't," Dazza was saying. "I haven't the equipment."

"Don't treat me like a stupid farm boy," Vyrl said. "The *Ascendant* has more than enough facilities. It's a flaming city."

The voices came from the entrance foyer. Kamoj hesitated in the Long Hall, near the entrance to the chandeliered ballroom, unsure whether to stay or leave.

"These aren't simple alterations," Dazza told him. "I would have to change your lungs and hemoglobin, redesign the way your body absorbs oxygen and carbon dioxide, and add filters for impurities. Who knows what side-effects it would cause? I couldn't even begin until I made a thorough study. Surely you realize the magnitude of what you're asking."

"Contact the *Ascendant*," Vyrl said. "Tell them to send down what you need."

"The web systems in this building aren't sophisticated enough to run the equipment," she said. "If you want me to work on you, we have to do it on the ship."

"No!"

Dazza spoke in a placating voice. "Vyrl, listen. Why change your body? Doesn't the respirator let you breathe in comfort?"

"I don't want a metal face."

"You *asked* for metal. It doesn't have to be that way. If it bothers you, we'll redesign the mask."

He made a frustrated noise. "The people here don't need respirators. If I'm going to live on this planet, I want to go out without anything."

"Why? Is this temporary exile worth such drastic changes to your body?"

Kamoj tensed. Temporary exile? Vyrl was going to leave Argali? What did that mean for her people? For herself?

She walked through the ballroom and stopped in the doorway to the Entrance Hall. Vyrl and Dazza were at the other end of the hall, in front of the entrance foyer. Azander and two other stagmen were standing back from them, trying to accomplish the impossible by being simultaneously attentive to their liege and oblivious to his argument.

"I told you what I wanted," Vyrl told Dazza. "Do it. I'm going riding."

"You're in no condition to ride—"

"Contact the *Ascendant*, damn it."

Dazza crossed her arms. "And if I refuse?"

"Don't push me, Colonel."

She exhaled. "Vyrl, stay here. Let me give you something to deal with the alcohol. Or let it work out of your system. When you're sober, we'll talk modifications."

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"You're not putting more of your bugs in my blood." He grimaced. "Those bloody things never die."

"Nanomeds aren't bugs. And meds designed to flush out alcohol do 'die.' They dissolve after a few—"

"No," he said.

She scowled at him. "If I alter your body so you can live on this planet unaided, you'll need even more self-replicating meds than the ones you carry now for health maintenance."

"Fine." With no warning, he spun around and strode up the hall, straight toward Kamoj. His sudden attention caught her off guard. She hadn't even realized he knew she was there.

A farmhand must have given him the clothes he was wearing, an old white shirt, soft and worn with washings, and rough pants tucked into scuffed boots. Although Maxard wore old clothes when he worked the farm, it was still the garb of a highborn man. It startled her to see the wealthiest man in the Northern Lands, possibly on all Balumil, dressed like the poorest farmer.

Before she could react or retreat, he reached her. He didn't even stop, just slid his arm around her waist and swung her around, then pulled her with him as he headed back down the hall. His longs legs covered ground so fast she had to run to keep up with him.

He stopped in front of Dazza. "My wife and I are going riding." Propelling Kamoj ahead of him, he stalked into the entrance foyer. He left her in the middle of the chamber while he went to where his cloak hung on the wall like a patch of evening sky.

Kamoj pushed her hand through her hair. What if she refused to go with him? Perhaps she was naïve, but she didn't believe he would do anything more than leave her behind. The idea of his going alone bothered her more. Could he safely ride, as drunk as he seemed right now? Suppose he fell from his stag and broke a limb? Or worse? She didn't know how it worked with his people, but among her own, a man thrown from a greenglass could die alone in the forest before anyone found him.

Vyrl smacked his palm on the wall, and a block of stone slid to the side, revealing a cubical cavity. He pulled out his silver mask. Crumpling it in his hand, he swung around and looked at someone behind her. "Bring Greypoint out front," he said.

Turning, Kamoj saw Azander by the great double doors of the entrance. A bruise purpled the stagman's chin where Vyrl had hit him last night. Azander pulled back the heavy bolts on the doors and leaned his weight into the left one until it swung open, letting blue-tinged sunlight pour into the foyer. Then he walked through the shimmer curtain, out into the autumn day.

Dazza spoke from the foyer's inner archway. "Vyrl, at least let Kamoj ride her own stag. She'll be safer that way."

"Safe from what?" Vyrl swung his cloak over his shoulders, the blue cloth swirling through the air like a swath of midnight-blue sky. "Military witch-doctors who want to fill my blood with bugs to stop me from enjoying a drink, but who refuse to fix my body so I can goddamn breathe?"

"Don't go riding," Dazza said. "Wait until you're sober."

Bi-hooves clattered on the flagstones outside. Vyrl came over to Kamoj and took her arm. Pulling her with him, he strode through the shimmer curtain, out into the sunlit courtyard.

Dazza called from behind them. "Vyrl!"

When he turned to the colonel, Kamoj's hope jumped. Would he change his mind and go back?

Dazza was standing in the palace entrance now, behind the shimmer curtain. "Your respirator," she said.

He watched her, the mask still crumpled in his fist. Then he spun around and drew Kamoj over to where Azander held a stag ready. The animal was huge and muscled, with gigantic greenglass

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antlers that shaded from emerald at their base into silver tips. Despite the stag's great height, Vyrl swung up onto its back with mesmerizing grace. Greypoint pranced sideways, shook his head, and stamped his four front legs. Then he stilled, becoming a statue as he looked down at Kamoj. His eyes, huge and green, with vertical pupil slits, stared at her with unsettling intelligence.

When Vyrl motioned, Azander put his hands on Kamoj's waist and lifted. At the same time, Vyrl reached down and grabbed her. He hauled Kamoj up in front of him so she straddled the stag, her flared skirt foaming over her thighs and knees. It happened so fast it made her dizzy. Or maybe it was the air, so thin after the palace. Vyrl held her around the waist with one arm, his mask clutched in his fist, while Greypoint danced under them, agitated with Kamoj's unfamiliar weight.

Suddenly the greenglass reared on his back legs, rising up, up, and up to his full height, his front four legs pawing the air, their scales splintering the light. Clangs filled the courtyard as he crashed his bi-hooves together. He threw back his head and bared his fangs, the opaline teeth glittering like daggers. And he screamed at the sky.

For one frozen instant Kamoj couldn't move, terrified she would fly off the greenglass. From this height the fall could break her neck. Then she grabbed its antlers, their velvety green scales slippery in her hold.

"Damn it!" Dazza shouted. "Vyrl, don't do this!"

The greenglass came down, jerking his head until Kamoj released his antlers. Vyrl's labored breaths rasped behind her. Kamoj twisted around to see him staring at Dazza, his face flushed. As Greypoint danced beneath them, on the verge of rearing again, Vyrl yanked a narrow slab out from his cloak, a rectangle covered with lines and symbols. Extending his arm, he pointed the slab at Dazza. "You can forget about having your orbital monitors track me, Colonel. I'm setting up a jamming field—" He pressed a blue light on the slab. "—now."

Dazza paled. "We want you here, Vyrl. What if something happens and we can't locate you?"

"Is that all any of you think about?" he rasped. "What you want?" He thrust the slab back in his cloak and grabbed Kamoj's shoulders. "*Look* at this. My wife. A farm girl like a virginal sex goddess out of an erotic holomovie, and all she asks is a simple life, a husband who doesn't beat her, and the freedom to walk in the woods. Did it ever occur to all your generals, politicians, and strategists that maybe that's all I want? That what I want might actually *matter?* Or are you all too busy plotting how to use your oh-so-valuable prince to give a flaming damn what I think?"

He jabbed the stag with his heels and Greypoint leapt forward, racing for the forest. Vyrl held the reins with both hands now, his arms around Kamoj. He was gasping, choking as if every breath hurt.

"Vyrl!" she shouted. "Put your mask on!" The wind carried away her voice. Desperate, she shouted in her mind. *Vyrl! Your mask!*

His arm moved and his breathing stopped. Dismayed, she twisted around—and stared into a face of silver scales. Jerking at the sight, she lost her balance. Vyrl caught her as she fell, but he misjudged his strength and almost shoved her off Greypoint in the other direction. She turned around and hung onto the stag's neck while they raced through the iridescent trees.

The dirt path they followed sloped upward, trees towering on either side, branches meeting overhead. Despite the cloudless day, thunder rumbled above the forest. Kamoj stiffened, wondering what other "marvels" Vyrl's outburst would call up.

"It's just a shuttle engine," he muttered against her ear. He slowed Greypoint to a walk and prodded him off

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the path, into the woods. The stag had calmed, his fire eased by the race. He trotted between the widely-spaced trees, his six legs moving with such smooth coordination that Kamoj barely felt the bumpiness of his bi-hooves hitting the ground. His muscular, long-legged grace reminded her of Vyrl.

They went deep into the mountains, always headed upward. Every now and then an "engine" grumbled overhead. Each time the sound came, Vyrl tensed, and each time it faded he relaxed again.

Eventually Kamoj said, "Where are we going?"

"Away. Until they find me." He sounded tired. "Actually, they always know where I am. But usually they let me come back on my own." He paused. "Except today I took the jammer. They'll have more trouble this time."

"Jammer?"

"What I pointed at Dazza," he said. "It works best against electromagnetic sensors."

"Lector's senses?"

"It confuses the things they use to find me." His voice slurred. "Neutrinos are harder to fool, though. They go through anything. But this jammer is a real beaut. It can create false shadows to throw off even neutrino sensors."

"Oh." Kamoj wondered if the rum made him babble, or if his words had some actual sense.

"What do you think is this Current you all worship?" Vyrl asked. "Electromagnetic radiation. Light. Those threads in your light panels are just optical fibers."

That gave her pause. In Iotaca, *Optical Fiber* was the full name of Lyode's husband, Opter Sunsmith. If their line ran true, their children would inherit the sunsmith talents. Opter's brother Gallium Phosphide Sunsmith worked in the sunshop with him. Other provinces had other gifts, such as the Amperman and Ohmston lines in Ironbridge. The Argali temple was dedicated to sun spirits, like the Glories and Airy Rainbows, but Kamoj had always seen them as guardians or even servants of the Sunsmith line, rather than deities.

"Why do you think we worship the Current?" she asked.

"Don't you?"

"The Current just is. Like rain, clouds, and sun."

"Not *like* the sun," Vyrl said. "It *is* the sun. Well, not just the sun. But light."

"Of course, Prince Havyrl."

"Don't call me that."

"That?"

"Prince Whatsit. You're my wife. Call me Vyrl."

"Yes, Vyrl."

"Why are you so formal? Last night, I even thought you were afraid—" Suddenly he stopped. "Saints almighty. I am an idiot."

Kamoj blinked, again caught off guard. Never, in a hundred Long Years, would Jax have ever said such a thing about himself.

"You had no choice, did you?" Vyrl said.

"Choice?"

"About the marriage. Bloody flaming hell. I should have seen it before. That wasn't a dowry. It was a purchase order." He pulled Greypoint to a halt and dismounted, swinging his leg over the stag's back and landing on the ground with leonine grace. Greypoint danced sideways, and Kamoj had to grab the bridle to keep from falling.

Standing with his back to her, Vyrl looked normal, a man with a mane of tawny hair. Then he turned and she saw the silver mask on his face. She tensed, almost as unsettled now by that blank expanse of metal as the first time she had seen it.

He peeled off the mask. "I hate this thing."

"Vyrl, no. You need to breathe."

"You must hate me."

"I don't hate you." Every time she thought she began to understand him, he went off on a rant again.

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He crumpled the mask. "You think you have to say that."

Although she meant what she said, his words gave her pause. Had Jax asked if she hated him, certainly she would have denied it. Otherwise he would have hit her.

Vyrl was concentrating as if she were a tangle of threads he was trying to unravel. "I'm not going to beat you. Gods, Kamoj, I would never do such a thing."

Her face gentled. "I like being with you. It's just . . ."

"Yes?"

"I don't understand you."

Vyrl gave her a rueful smile. "That makes two of us." He pressed the mask onto his face, then came over and reached for her. As he helped her off the stag, she put her arms around his neck and hugged him. He held her with her feet dangling in the air while he pressed his lips against her hair.

"I have a place out here where I go to be alone," he said. Then he set her down on the ground and took her hand.

They went to an outcropping of moss-covered slabs half-buried in the ground. Bridle bells clinked as Greypoint followed them. Vyrl stopped and rubbed his mount's neck, pressing on the scales in that way greenglass stags liked. Greypoint stood quietly, patient while Vyrl removed the bridle and tended him. The stag pushed his long snout against Vyrl's palm, nipping at his fingers with fangs that could have torn Vyrl to pieces, had Greypoint wanted. Then the greenglass took off, running in a graceful six-legged lope among the trees.

Vyrl glanced at Kamoj. "Don't worry. He'll come back."

She spoke softly. "I know." Greypoint's behavior told her far more than Vyrl realized. After working all her life in the glasshouses stables at Argali, she knew greenglass stags. Greypoint was wild, never broken or tamed. A gifted stagman might attract the interest of a wild stag, but never one as high-strung and powerful as Greypoint. That the animal freely chose to follow Vyrl impressed her more than all Vyrl's wealth, titles, and palace repairs.

Vyrl led her through an opening in the rocks into a small cave. It had a roof half again as tall as Vyrl and a floor of packed dirt, with boulders jutting out here and there. He knelt at a platform beside the entrance and ran his fingers over its dark surface. Despite all the wonders Kamoj had seen here, it still stunned her when lights appeared within the platform, glowing and winking. A hum began, and a shimmer curtain appeared in the entrance of the cave, blending into the rocks on either side.

Vyrl sat back on his heels. "The generator will bring the atmosphere to normal. Normal for me, that is."

She stood just inside the entrance. "Why can't you breathe the air?"

"A lot of reasons. Too much carbon dioxide. Too little oxygen. All the scale dust in it." He seemed distracted, either tired or depressed. "The irradiation from your sun is lower than the human standard. That means it doesn't give Balumil as much light. The extra carbon dioxide helps keeps the temperature up." He touched the mask on his face. "This concentrates oxygen and filters out CO_2. It also filters out impurities that gives gamma humanoids a severe form of asthma. Fatal, in fact, if we breathe it too long."

"Gamma humanoid?"

"Like me." He pressed his palm against his chest. "I can tolerate the air here for a short time, but some people can't bear it even for a few seconds."

"It doesn't bother me at all."

Vyrl smiled. "You're a theta." He took off his mask and dropped it on the console. "Your lungs have filters that mine lack. Your people's hemoglobin was redesigned and your circulatory system responds to different partial pressures of oxygen and carbon dioxide." He rubbed the bridge of his nose with his thumb and forefinger. "This world is almost uninhabitable for those of us without your modifications, especially during winter

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and summer. That's why your ancestors wore space suits."

"Space suits?"

"You know those pictures of ancient stagmen in full-body diskmail?" When she nodded, he said, "Those are space suits."

She poked her finger into the shimmer curtain. "And this?"

"It's an airlock. It surrounds the cave." He paused. "I'm not sure how to describe it in a way that would make sense to you."

"Tell me in your own words then. I like to hear them." Now that she knew he wasn't mocking her ignorance, she found a beauty in his words, the promise of knowledge and wonders.

"The curtain is a membrane," he said. "A modified lipid bilayer." He tapped the platform. "This applies an electric potential to it. There are enzymes in the membrane, like keys, but so tiny you can't see them. They fit certain receptor molecules. Certain locks. Different potentials activate different keys. When a key opens a lock, it changes the permeability of the membrane." He paused, lines of fatigue deep on his face.

"Are you all right?" Kamoj asked.

"Yes. Fine." He stood up. "Right now the membrane won't let air pass, but water can diffuse through it just fine. The generator recycles our air, so we don't suffocate. It also seeds the air with nanomeds that take dust out of the air."

Kamoj thought of the firepuff fly that had stuck to the shimmer in her chamber last night. "The curtain lets us pass through it."

"On this setting, yes. We're easily strong enough to push through it. Your body becomes part of the interface, keeping the seal." He pressed the heels of his hands against his temples. "A picoweb within the membrane remembers its original form, so after you pass, the curtain returns to normal."

"Vyrl, are you sure you are all right?"

"It's just a headache." He pulled a bottle out of his cloak and unscrewed the top. Then he drank deeply, tilting his head back as he swallowed.

Watching him, Kamoj felt a sense of helplessness. Her only experience with anyone who drank this much was Korl Plowsbane. Would Vyrl become that way, decimated and dulled, with no family or friends, only the bottle he loved above all else? She had no idea what to do. She had seen how angry he became if Dazza even mentioned it.

He walked across the cave, his boots scuffing up swirls of iridescent dust. The generator hummed, making its nanomeds to carry the dust out of the air, so it wouldn't kill her husband.

Vyrl turned to her. "That day at the river—you have no idea. I was so close to going after you. Just one bodyguard you had, to my four stagmen." He raised his hand, palm up. "'But no,' I thought. 'Do you want her to hate you? What of honor? Decency? All that.' So I courted you. Or I thought I courted you." He took another swallow of rum. Lowering the bottle, he spoke with self-disgust. "Seems I raped you anyway."

"That's not true." How could he be so empathic and not see that she liked him? She had never wanted Jax to touch her, but after Vyrl's gentleness last night even the thought of Ironbridge revolted her.

"I *knew*, damn it!" Vyrl said. "I knew you wanted me to stop last night. You even cried it in your mind." He sat on a hip-high boulder and took another swallow of rum. "Self-delusion is remarkable, isn't it? I convinced myself you wanted me."

"You weren't deluding yourself," she said.

"You think you have to tell me that. Because I *bought* you." He let the empty bottle slide out of his hand. It hit a half-buried rock and broke into pieces. Watching her, he said, "You aren't bound to me, Kamoj. You're free. I'll have the *Ascendant* move our base to some other place. We'll tell your people—hell, tell them what? That I went

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back to my own 'land' and will send for you. Then we'll send word I've been killed. That way you'll be free of me without being humiliated."

"Killed?" She couldn't believe what he was saying.

"Imperial law recognizes unions made in the colonies, even the rediscovered ones like this. That means we're married by my law as well as yours." He spoke awkwardly. "I'll have someone arrange divorce papers."

How could he speak her language, yet say so much she didn't understand? Enough made sense, though. He meant to dissolve their merger. The realization stabbed like broken glass. With news of Vyrl's "death," Jax could claim the widow. Ironbridge would get everything: Argali, the redone palace, Morlin, all of it.

Kamoj went over to him and toed aside the broken bottle. Shyly, she put her arms around his waist. "Stay with me."

His arms went around her. "You don't have to say that."

"I know." She hesitated. "Unless you want to go."

"Gods, no." His hand moved over her hair. "Are you sure?"

"I'm sure."

"Even after last night?"

"Especially after last night." She tried to recapture her feeling from then, so he would too. Rubbing her cheek on his chest, she inhaled his scent. Then she reached for him with her hand, seeking to give to him what he had given her. As she held him, he brushed his lips over the crown of her head and stroked his palm down her back, over her curls. After awhile, he pulled off the scarf she used for a belt and helped her fold it around him. Tensing with his release, he exhaled, then he murmured words from an old Argali harvest song: "'So soft is her touch on grain full with nectar . . .'"

Smiling, Kamoj looked up at him. As he relaxed against her, his eyelids drooped. Their metal lashes made a glittering contrast to the dark circles under his eyes.

"Let's lie down," she said. "I'm tired." She wasn't actually, but Vyrl obviously needed to sleep. Why he fought so hard against it she had no idea, but perhaps he would do for her what he wouldn't do for himself.

"All right." He straightened his clothes, then stood up and swung off his cloak. It swirled through the air and settled on the ground. As Kamoj sat on it, he watched her like a greenglass mesmerized by night lamps on a coach. "So pretty . . . your dress. That color. What d'you call it? Rose? 'S nice the way you fill it out—" He suddenly turned red. "Ai. I'm rambling. What an idiot you married."

Kamoj couldn't help but smile at his boyish expression. "No, you aren't. Don't ever say that." She patted the ground. "You lie down. I'll rub your head."

"Won't argue with that." He lay down and put his head in her lap. As she massaged his temples, his eyes closed. Within moments his breathing had settled into the steady rumble of sleep.

Watching Vyrl sleep, Kamoj wondered how to understand him. He spoke like a highborn man, dressed like a farmer, carried a title, had a laborer's callouses, moved like a dancer, and had a stagman's gift with greenglasses. The silver in his hair and the lines around his eyes suggested he had reached his forties, yet he had the powerful physique and vigor of a younger man. His wide-open emotions and beguiling flashes of mischief made him seem almost boyish.

Beneath all that, though, buried also under his mood swings, his drinking, and his tormented dreams, she sensed a slumbering satisfaction with life that came from well-advanced years, not for everyone, but for some. He obviously wasn't happy now, yet for some reason she believed she picked up a deeper contentment, the kind it took a lifetime to form. Was she imagining it?

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"Vyrl, what are you?" she murmured. Elderly, middle-aged, or young? Prince or farmer? Athlete or stagman? Drunkard or wise man? Or all of that? Brushing back his hair, she decided she would simply try to accept him for himself.

After a while she moved out from under his head and lay down beside him. Outside a quetzal called and another answered. Branches creaked in the wind. She could imagine the woods, ancient trees nodding together, their heads lifted high above the ground. If she were a bird, she could rise out of the forest and see it rolling in wave upon iridescent wave through the mountains, beneath the limitless violet plain of the sky.

SWORD AND BALLBOW
Perturbations

A shudder racked Vyrl's body, waking Kamoj. Deep in his dreams, he made a strangled noise, his face clenched. She pushed up on her elbow and massaged his head until he calmed.

When he was resting well again, she went outside and stood watching the forest. Morning had passed, bringing them into early afternoon. Overhead an "engine" rumbled. She wondered if it knew Vyrl was here.

When she returned to the cave, she found him sitting up. Although fatigue still lined his face, he looked more rested.

"Is there anyone out there?" he asked.

"I heard an engine. I didn't see anyone, though." She sat cross-legged in front of him. "May I ask you a question?"

"Of course."

"What are you a prince of?"

He shrugged. "Nothing, really. I'm just a citizen of the Skolian Imperialate. It's about nine hundred worlds governed by an assembly of elected counselors."

"You are not a prince?"

"I've the title. But it doesn't mean much." He considered her. "Tell me what you know of Balumil's history."

She thought of the stories she had learned as a child. "Long ago the Current gave light and warmth to our houses. And voices." Like Morlin, she realized. Vyrl had given the Quartz Palace back its voice. "Sailors brought the people here on ships that flew above the sky."

"That fits."

His response surprised her. She would have expected him to smile at their fanciful tales. "How does it fit?"

He rubbed his neck, working out the kinks that came from sleeping on the ground. "The ancient Ruby Empire established this colony. That's why I know your language."

It didn't surprise her that their language had remained constant enough for him to understand. Her people never changed anything. Change brought upheaval, upheaval threatened revolution, and revolution was anathema.

But still, it had been a long time. "The sky sailors vanished five thousand years ago."

"That's when the Ruby Empire collapsed. Five thousand standard years ago."

"Standard years?" That sounded like the scroll in Jax's library.

"About the length of the year on Earth, or on the world Raylicon. Just a bit more than one of your short-years." He stretched his arms. "Originally we all came from Earth."

Earth. The word had an odd familiarity, in the same way as did the pupils of Vyrl's eyes. "What is Earth?"

Softly he said, "Home, Kamoj. For all of us. Green hills, blue sky, sweet fresh air."

His words evoked a sense of ancient mysteries, of mythical quetzals without scales flying in an eggshell blue sky. "If home is a place called Earth, why are we on Balumil?"

Dryly he said, "Many people would like the answer to that." He pushed a lock of his hair behind his ear. "About six thousand years ago, around 4000 BC, an unknown race moved a population of

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people from Earth to the world we call Raylicon." Anticipating her next question, he said, "We don't know why. They disappeared without so much as a 'Sorry about this.'" He shrugged. "My ancestors eventually developed interstellar travel and went searching for their lost home. Although they never found Earth, they built the Ruby Empire." A grin flashed on his face. "But Earth found us. Just a few centuries ago."

"Is that how your people were able to return to the stars?"

He scowled, obviously offended. "Of course not. We relearned interstellar propulsion ourselves, well before anyone from Earth showed up." Then he laughed. "Ai, Kamoj, what a great surprise it must have been. When Earth's emissaries reached the stars, they went looking for alien cultures and found us instead, their own siblings, busily rebuilding empires. Gave 'em one hell of a shock."

Smiling, she said, "You look quite smug about that." When he chuckled, she asked, "And Balumil was a colony of your Ruby Empire?"

"That's right. We've been reclaiming the old colonies and settling new worlds. We call ourselves Skolia now, though, or the Skolian Imperialate."

She tried to fit it together. "How are you a prince?"

Vyrl shifted his weight. "My mother descends from the Ruby Dynasty."

"Ruby Dynasty? From the Ruby Empire?"

"That's right. The House of Skolia."

"Skolia is your family name?" When he nodded, she spoke quietly. "You are a great man, to rule nine hundred worlds."

He looked uncomfortable. "It's a meaningless title. My family hasn't ruled anything for thousands of years. I'm just a farmer."

She sensed unspoken subtleties in his words. "Dazza's people hold you prisoner because you have value to them."

He stiffened. "I'm not their prisoner." When she just looked at him, he said, "They have their reasons."

"Good reasons or bad?"

The question seemed to surprise him. "Valid reasons."

"Why?"

After a pause he said, "The Ruby Empire had a thriving slave trade. My ancestors in the Ruby Dynasty outlawed it. That was one reason the old empire fell. The Traders went to war against my family." Tiredly he said, "Now it's all started up again, even worse than before."

She tensed. "Is that why you are a prisoner? Is Dazza a slave trader?"

He appeared taken aback by the question. "Good gods, of course not. Dazza Pacal is a colonel in the pharaoh's army, the oldest branch of Imperial Space Command, the Skolian military. The army dates back to the Ruby Empire. One of my ancestors, the first Ruby Pharaoh, founded it."

Relief washed over Kamoj. "So it is your people who are holding you captive."

"If you mean, did ISC bring me here, the answer is yes." He shifted his weight. "I wouldn't use the word 'captive.'"

"Then why won't they let you go?"

"Members of my family have neural structures that make our brains more sensitive to certain atomic and molecular interactions. What I told you last night. Our ancestors were designed that way." At her puzzled look, he said, "It means we can power Ruby machines that have survived the millennia. We haven't relearned the tech yet, but we can use what we have."

"This is a thing of value?"

"Very much. It allows us to access universes with different laws and characteristics than the spacetime we inhabit. Relativity as we know it has no meaning there."

She gave him a dubious look. "These odd-sounding things have value?"

Vyrl smiled at her expression. "Indeed. They make possible almost-instant

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communication. Signals are otherwise limited by the speed of light."

"You mean by the Current?"

"That's right." His grin flashed again. "We can beat the Current, Kamoj. It gives ISC a speed and precision the Traders can't match." His smile faded. "It's the only reason we've survived against them."

That he could beat the Current impressed her. No wonder his family had such great value to his people. "But where is the rest of your family?"

This time his silence stretched out so long she wondered if she had given offense. Finally he said, "My father came from another of the rediscovered colonies." He spoke with difficulty. "He was a simple man. A farmer. But he was also that one in a trillion, a Ruby psion." Anger leaked into his voice. "We're thoroughbreds, exotic and rare. For reasons our geneticists don't yet understand, attempts to make us in the lab fail." He shrugged, a gesture all the more eloquent for its attempt to indicate a nonchalance he obviously didn't feel. "But my parents could have children. So the assembly made them do it."

"Hai, Vyrl." She watched his face, trying to understand the shadow on his mood. "And your ISC needs you to protect your people?" When he nodded, she asked, "What about Earth? Do they fight too?"

"They stayed neutral during the last war. But they provided protective custody for my family." He pushed his hand through his curls. "The problem was, after the war ground to a stalemate, Earth refused to release us. I'm the only one they don't have. ISC keeps me guarded because they fear I will be kidnapped or assassinated otherwise."

"I see. I think." Kamoj tilted her head. "Your own people hold you prisoner to keep you from being held prisoner by the allies who were supposed to protect you from being taken prisoner or murdered by your enemies."

He gave a rueful laugh. "That about sums it up."

She took his hand. "Why did you come here?"

His fingers curled around hers. "I asked ISC to let me live in an agrarian culture similar to that of my homeworld, Lyshriol. A place where life revolved around the land and the harvest."

"So you really are a farmer."

His face gentled. "Yes. It's all I've ever wanted to do."

That she understood. Lifting his hand, she kissed his knuckles. He pulled her into his arms and they sat in silence, listening to the rustle of the forest.

A twig cracked.

Vyrl swore under his breath. They stood up, and he went to the entrance, where he paused to one side, poised and tense.

A man stepped through the shimmer. He wasn't one of Vyrl's guards, however. Rather, he wore the garb of an Ironbridge stagman. An archer. He had his bow up and aimed at the place where Kamoj and Vyrl had been sitting just seconds ago.

Vyrl didn't wait to see if the man meant to attack or only threaten. Lunging forward, he yanked the bow out of archer's hands. When the startled stagman clenched his fists together and brought them up under Vyrl's chin, Kamoj tensed, afraid the archer would snap back Vyrl's head and injure his neck. But Vyrl twisted with an easy grace, making even the agile stagman look clumsy. The blow just glanced off his cheek.

Then Vyrl hauled off and socked the archer. Staggering back, the archer hit the wall and knocked his head on the rock. As he slumped to the ground, Vyrl lunged forward and pulled the man's sword out of its sheath with a hiss of metal. While Vyrl stepped back, holding the sword, the dazed archer looked up at him.

"Does Ironbridge know you're here?" Vyrl asked.

The stagman rubbed his face, recovering himself. Moving stiffly, he stood up

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and brushed off his clothes. Then he turned to Kamoj and said, "Slut."

As Kamoj's mouth fell open, Vyrl said, "Call her that again and you won't have a tongue any more. What's the matter with you?"

The man snorted. "Be quiet, boy."

"Oh." Kamoj finally understood. "Vyrl, he thinks you're a farmhand."

Vyrl regarded him. "Is that true?"

The stagman had the sense to start looking worried. "Yes."

"I'm Havyrl Lionstar," he said. "And if you ever call my wife a slut again, then after I cut out your tongue I'll hang you upside down from a tower of the Quartz Palace and let the bi-hawks peck out your eyes."

Kamoj wondered if he were serious. The stagman stared at him for a full count of five before he remembered himself. Then he dropped to one knee and lowered his head so his hair fell forward, leaving his neck bare. "I have no excuse, Governor Lionstar. Use my sword."

Vyrl made an exasperated noise. "I'm not going to cut off your head. Get up and tell me why you were skulking around my woods."

Moving with obvious, albeit belated, humility, the stagman stood up. "Please accept my most abject—"

"Just answer the question," Vyrl said.

"I was riding to the Quartz Palace, bringing salutations from Ironbridge on your wedding." The man paused. "When I came by here, I saw the bridle and thought a rider was in trouble. I investigated and heard voices. I recognized the woman." He glanced at Kamoj, then quickly shifted his gaze to Vyrl. "I heard her call you a farmer and your agreement. It seemed that given the, uh, appearance of this matter, I ought to apprehend—I mean—what I thought—"

"I get the idea," Vyrl said. "Why are you up here? The road to Ironbridge is on the other side of the palace."

"I was coming from another errand for Governor Ironbridge."

Vyrl motioned toward the entrance. "Outside."

The man obeyed, his back stiff, either with fear or shame. Kamoj didn't believe for one second Jax had sent "salutations." He was having her watched.

As Vyrl followed the stagman, he nodded to Kamoj. At first she wasn't sure what he wanted. Then she remembered. The mask. He couldn't do something as simple as walk into the forest without endangering his life.

She retrieved the mask and also Vyrl's cloak. With her arms full of Argalian wool, she stepped out into a breezy afternoon. Vyrl and the stagman were standing about twenty paces away, Vyrl still holding the sword. He looked as if he was threatening the stagman with the man's own weapon, but as Kamoj came closer she realized he was only giving the archer directions to the road.

It didn't surprise her that Vyrl intended to let him go. The archer looked tense, though. Disbelieving. That didn't surprise her either. Had one of Vyrl's stagmen attacked Jax, Ironbridge would have sent the attacker to prison, possibly even executed him.

Then, in her side vision, she saw the trees move. "*Vyrl!*" she shouted. "Look out!"

Vyrl spun around just as a bowball hurtled toward him, the kind with an arrow embedded in the marble. It slammed against his side, the arrow stabbing deep into his body. Then the weight of the falling ball yanked out the arrow, pulling shreds of muscle with it.

As blood spurted from the wound, Vyrl staggered, and the stagman lunged to regain his sword. He almost recovered it; Vyrl was already injured, and the stagman was well trained. But Vyrl handled the weapon like an extension of his body. Metal flashed in the dappled forest—and Vyrl thrust the blade into the stagman's chest.

"No!" Dropping Vyrl's cloak, Kamoj ran toward them. A second bowball whistled through the air and hit Vyrl. He

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was moving, so it missed his heart and slammed into his chest below his shoulder. This time he managed to grab the shaft of the arrow before the falling ball ripped it out of his body. The weight of the ball broke the arrow, leaving its upper end embedded in his muscles.

A great roaring noise filled the forest, and the cry of a siren. With shock, Kamoj realized the siren was coming *out* of Vyrl's body. Wind thrashed the trees overhead.

As Kamoj came up to Vyrl, another ball hurtled between them. Vyrl tried to shove her away, to safety. "Stay back!" He had to shout to be heard above the noise.

He sank to his knees, his face contorted with pain. Blood soaked his shirt and pants, and the stagman lay dead at his feet. No, not dead; blood still pumped out of his wound. But Kamoj recognized mortal injuries: neither Vyrl nor the stagman would live much longer.

Dropping next to Vyrl, she pressed the mask over his face, trying to make it stay as he gasped for air. Before she had it in place, someone grabbed her arm and yanked her back. Twisting around, she found herself looking up a second Ironbridge stagman, another archer, almost certainly the one who had shot Vyrl. She struggled as he dragged her back, but she couldn't pull free. Frantic, she threw the mask at Vyrl—and saw it hit the ground beyond his reach.

"Let me go!" she shouted at the stagman.

His mouth moved, but she couldn't hear him. The whole forest was in motion now, come alive, trees parting overhead while the wind roared.

Incredibly, Vyrl made it to his feet and stumbled toward them, his hand clutched on his side, blood running over his fingers. Then he fell, barely managing to put his hand out in time to cushion the impact. His face had gone pale, a mask of death to replace the silver mask that lay beyond his reach.

"*Let go of me!*" Kamoj shouted. Wrestling in the archer's grip, she looked up—

And froze. A giant black and gold bird was cutting a swath through the trees, blasting away scales and dirt. The roar of its descent drowned out even the siren from Vyrl's body.

As soon as the bird landed, its mouth gaped open. *People* ran out of its throat, Dazza and others in gray uniforms, all sheathed in shimmers that molded to their bodies. Two Lionstar stagmen came also, Azander and another man. The unfamiliar Lionstar man raised his arm and pointed a tube at the Ironbridge archer that held Kamoj.

"Ah—" With a stunned expression, the archer collapsed. The Lionstar man looked disconcerted, as if he hadn't been sure what would happen when he did whatever he had done with the tube.

Kamoj tried to run to Vyrl, but one of the shimmer-sheathed strangers caught her and held her back. The other healers were kneeling around Vyrl. As one of them placed a translucent mask over his face, Dazza worked dials on a cylinder connected by a cord to the mask. Two other healers lifted him onto a stretcher.

Impossibly, the stretcher rose off the ground on its own. Grabbing its ends, the healers ran for the metal bird. Dazza went with them, running by the stretcher. Two more of Vyrl's people laid the dying Ironbridge man on a second stretcher and followed the first group. The siren from Vyrl's body still rang throughout the trees.

Kamoj struggled in the grip of the healer that held her. "Let me go with him!" she shouted. When he only tightened his grip, she screamed, "*Let me go!*"

Still running, Dazza glanced back. "Let her come," she called. Then she disappeared into the bird's throat.

The instant the healer released her, Kamoj took off. She had no time to consider the consequences of running into

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the mouth of a giant metal bird. Its jaw was already closing. She barely had time to race inside before it snapped shut behind her. Two more steps took her through the throat—and into a nightmare.

The bird's stomach was a demon's nest of tubes and metal curves, surfaces that gleamed, light panels, other things she had no names for, looping coils and projections like clawed hands.

Suddenly the bird lurched. Kamoj lost her balance and slid to one knee, her shoulder hitting the metal "wall" that lined the beast's gut. A roaring filled the air and the bird vibrated around her. As it grumbled and boomed, a great invisible hand shoved her against the wall of its stomach.

The Lionstar stagman who had knocked out the Ironbridge archer knelt on one knee at her side, his presence both reassurance and an offer of protection. She managed to incline her head in gratitude. He nodded back, his face as pale as a white-skeeted snowlizard. She suspected he had no more love of riding in the innards of giant metal birds than did she.

A few paces away from them, Vyrl lay on a pallet enmeshed in coils and jointed metal arms. The siren coming from his body abruptly cut off, leaving a calm broken only by the muted clinks and hissing of the bird's guts. The Ironbridge man lay on another pallet, surrounded by healers. Kamoj couldn't tell what was happening with him, or even if he still lived.

Vyrl, however, was very much alive. He had ripped the mask off his face and was grabbing at a tube Dazza kept trying to press against his arm.

"I won't be put to sleep like some wild animal!" he told her.

"Stop fighting," Dazza said. "It will drive the arrows deeper into your body."

Either he didn't hear or didn't care. He kept struggling, until finally the healers fastened down his limbs with straps. Still he fought, his face flushed as he strained against his bonds. It terrified Kamoj to see him that way, like a man possessed.

"Prince Havyrl, you have to hold still," a man said. "We can't get the arrows out." In almost the same instant, Dazza said, "The sedative isn't working," and another man said, "I'll try Perital." As the man pressed a tube against Vyrl's arm, Vyrl swore, the tendons in his necks as taut as cords. His eyes rolled back into his head and his body went rigid—no, not rigid, it was *jerking*—

Someone yelled, "What the—?" and a new siren went off. In the same instant, Dazza shouted, "Give me an air-syringe!" while a woman said, "Saints almighty, what kind of neural map is that?"

Vyrl's entire body spasmed against the restraints, convulsing back and forth. As Dazza slapped another tube against his arm, someone else said, "I'm reading discharges all over his brain," and another healer shouted, "We have to clear—damn! The arrow punctured his lung."

Kamoj rocked back and forth, agonized. Vyrl was dying and she was helpless to do anything. Even his healers couldn't stop the demon that wracked him like a stick-man made of twigs.

"Give him more meds!" Dazza said. "Double-dose the chest wound."

"He's got too many in his body already," a man said.

"Do it!" Dazza ordered.

A woman said, "Heartbeat and blood pressure dropping below critical levels. Colonel, we're losing him."

"No. Gods, *no*." Dazza gripped the pallet. "Vyrl, come back! Don't let go. Not *now*. Not after you've come so far."

"The nanomed concentration in his blood is too high," a man said. "They're starting to break down his tissues."

"Clean them out," Dazza said. "Neutralize *now!*"

Vyrl stopped jerking. As his body went limp, a healer said, "Neural inhibition working. Neurons fatiguing." Riding on the tail end of her words, a

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man said, "His right lung collapsed," and another said, "Med concentration decreasing."

Dazza glanced at a man bent over a panel of lights. "Can we save the lung?"

"The meds got to the puncture site before we flushed," he said. "I've got the pneumothorax under control and regeneration around the wound is taking."

The colonel nodded, then turned to a woman who was studying a collection of ghosts above a silver platform. "What happened to him?" Dazza asked.

"That was a *grand mal* seizure," the woman said. "A generalized tonic-clonic attack, like an epileptic convulsion. I haven't tracked down the cause yet."

"There!" a man said. He held up the arrow that had been in Vyrl's chest. When Kamoj saw blood gush out of Vyrl's wound, bile rose in her throat. It wasn't the blood; she had tended injured farm hands with wounds just as serious. But it had never been her husband before, bleeding away his life. His lung had *collapsed.* How could he survive such wounds?

Someone said, "We have the second one," and held up part of another bloody arrow. Kamoj hadn't even realized part of that one had stayed in Vyrl's body. Other healers attached patches to the inside of his elbows while a man pressed a tube against his neck.

"Colonel, I've got what caused his seizure." That came from the woman bent over the silver ghosts. "The last sedative, the Perital, interacted with the alcohol in his bloodstream. It set off a reaction in the series-N nanomeds he carries, which acted on the psiamine receptors in his brain. With all those extra neural structures he has up there, it was too much. His neurons started firing like mad and the excitation spread." She glanced at the doctor. "His brain went into overload."

Dazza nodded tiredly. "Log the whole cycle, Lieutenant. Next time we'll know."

A man's voice came out of the air. "Colonel Pacal, shall I take the shuttle up to the *Ascendant?*"

"Yes," Dazza said.

"No," Vyrl whispered.

Dazza leaned over him, two tears running down her cheeks. "Holy saints, Vyrl, don't you ever stop arguing?"

Opening his eyes, he looked up at her. "Never want . . . see that medical bay again."

Her voice gentled. "We need its equipment."

"Everything you need . . . at palace."

"I'll feel better with you on the ship."

"Won't go back there."

"I can have Jak Tager meet us at the docking bay—"

"No! Told you. Don't *need* him."

"Vyrl, I'm sorry. But I want you on the cruiser."

His eyes closed. "Then the hell with you."

"Doctor-Colonel," Kamoj said.

Dazza looked up. "Kamoj? Are you hurt?"

"No, ma'am." She tried to make her voice calm, so Dazza would listen to her, but it made the words come out stilted. "If you break the spirit of a greenglass, you can still force it to serve you. But it will serve neither willingly nor well. Break the king of the stags and the entire herd dies."

"What the hell?" a healer said. Another said, "She's just a kid. She's probably scared."

"No." Dazza was watching Kamoj. "I know what she means." She pushed her hand through the silver tendrils of her hair. Then she said, "Major, change of orders. Take us to the palace."

The disembodied voice said, "Will do, ma'am."

Kamoj closed her eyes with relief. When she opened them, Azander was watching her from the other side of the bird, where he stood against a wall. He nodded as if to thank her for intervening on Vyrl's behalf. Then he dropped his gaze to indicate respect. She swallowed, grateful he saw her as an ally now instead of an enemy.

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"Colonel Pacal." One of the healers working on the Ironbridge man spoke. "We've a problem."

"What's wrong?" Dazza asked.

"We're having trouble replicating this man's erythrocytes. We need a transfusion from someone native to this biosphere."

"Do you have a compatible donor listed in the files?" Dazza asked.

"We aren't sure." The healer glanced up at Azander. "Can you try? You're the closest match."

Azander nodded, seeming to understand the odd words. He moved away from the wall and knelt by the Ironbridge soldier. The healers attached tubes to his arms that went to their various machines. Silent and tense, they concentrated on their displays, their faces furrowed as the studied the flickering ghosts.

Suddenly one of them said, "It's good."

With obvious relief, the healers made more adjustments to their boxes, then used the tubes to connect Azander with the dying stagman. Soon red liquid was moving through the tubes. Azander remained utterly still, like a statue, staring at the liquid as it flowed, his face pale. With a jolt, Kamoj realized his *blood* was in those tubes.

Finally a healer said, "We have replication." Others went to work on Azander and his blood stopped flowing. Soon they had him free of their machines.

"Will your patient survive?" Dazza asked.

A healer working on the Ironbridge archer said, "It looks like it."

Kamoj stared at them. Who were these people, that they could give life to a man who for all intents and purposes was already dead?

Turning back to Vyrl, Kamoj saw he had succumbed to the sleep makers. Or she thought he had. Then he mumbled something.

Dazza leaned closer. "Again?"

"Kamoj," he said.

"She's here," Dazza said. "We're going to the palace."

"Good . . ." Vyrl's breathing eased into sleep.

He looked so pale. But Kamoj saw no blood, neither on his body nor spilled onto the bird's guts. In fact, she couldn't see his wounds at all. Where ragged gashes had rent his body, now new skin showed. Then she realized the "skin" was a bandage.

"Colonel." The voice came out of the air. "We're coming into the palace."

Dazza glanced at the healers around the Ironbridge man. "As soon as we have Prince Havyrl off the shuttle, take your patient up to the *Ascendant*. I don't want him anywhere near the palace until we figure out why the two of them were trying to kill each other."

An odd sensation came over Kamoj, as if she were falling. The bird jolted and its dull thunder stopped. In a whoosh of air its mouth gaped open, leaving only a shimmer. Sunshine poured into the stomach.

With the Lionstar stagman at her side, Kamoj walked through the mouth. Incredibly, they came out onto the courtyard in front of the palace. The stagman glanced at her and spread his hands, the disquiet on his face mirroring what she felt. Only moments ago they had been in the forest.

The healers brought Vyrl out on the floating stretcher, with a silver sheet over his body. Servants threw open the doors of the palace and the healers strode inside.

Kamoj slept in a sitting position, leaning against the headboard of the bed. Vyrl lay next to her, either asleep or unconscious. Each time she awoke, she saw Dazza in an armchair by the nightstand, watching Vyrl, dozing, or studying images in her book-box.

Sometimes the colonel spoke to the nightstand. Different voices answered, most in unfamiliar languages. A few used their odd Bridge dialect. Dazza dis-

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cussed Azander's *paramedic* training with one, saying she wanted more of the household staff to learn it. Another voice told her the Ironbridge stagman was recovering on the *Ascendant.* Later someone said a delegation from the *Ascendant* had gone to Ironbridge to speak to Jax.

From what Kamoj gathered, it sounded like Vyrl's people were holding the second Ironbridge archer in Argali, until they decided what to do about his shooting Vyrl. Apparently the Lionstar stagman had knocked him out with a sleep weapon. Kamoj didn't understand how a tube could carry sleep or how a person could throw that sleep at others, but nevertheless, it had happened.

She was dozing when a rustle of sheets woke her. She opened her eyes to see Vyrl jerking, restless with his dreams. Dazza sat slumped in her chair, asleep, but when Vyrl groaned she snapped awake. The doctor took one look at him, then opened her case and removed a black tube. She stood up, leaning over Vyrl as she brought the tube to his neck.

"Wait," Kamoj said. "He hates that."

Dazza exhaled. "I know. But if he jerks like that, it could tear open his wounds."

Vyrl's fingers curled into claws. His breathing had grown ragged and his forehead contorted as if he were in pain.

"There might be another way." Kamoj slid the pillow out from under his head and put herself in its place, sitting cross-legged with his head in her lap, his curls spread across her legs in red-gold profusion. Then she massaged his head. As she worked, his face relaxed and his breath slowed to an even rhythm.

"Well, I'll take a launch off a lily-pad," Dazza said.

Kamoj looked up at her. "Ma'am?"

Smiling, Dazza said, "It seems you're effective alternative medicine."

Kamoj hesitated. "May I ask a question?"

"Of course."

"That sound Vyrl's body was making today, when he was hurt. How did it do that?"

"He has an implant," Dazza said. "If he's in trouble, it sets off alarms, including the siren. It also activates a neutrino beacon. That's how we found him." She paused, her head tilted as she considered Kamoj. "May I ask a question?"

It felt odd to have the doctor request permission to seek information. Kamoj had no idea what position "colonel" occupied in the hierarchy of things, but Dazza clearly ranked high among Vyrl's people.

"I will answer to the best of my ability," Kamoj said.

"Why did Vyrl try to kill the Ironbridge man?"

"Because he tried to kill Vyrl."

"The Ironbridge soldiers claim they acted in self-defense." Dazza settled back into her chair. "We've done scans on them. They're both telling the truth as they see it."

"Didn't know who I was," Vyrl mumbled. He opened his eyes and looked at Dazza, his gaze bleary.

She leaned forward. "How are you feeling?"

"Lousy." He closed his eyes. "Flaming sedatives."

"I'm sorry," Dazza said. "But I had to do what I thought necessary." With the look of someone who already knew what response she was going to get, she added, "That's why I've posted Jagernauts as your bodyguards. You will have two with you at all times, even in the palace. Right now they're on the landing of this suite."

His eyes snapped open. "Damn it, Colonel. I'm tired of privacy being a luxury I'm forbidden."

She crossed her arms. "What did you expect? That ISC would stand by while you steal state-of-the-art special operations gear, ride off in a drunken rage, and almost get yourself killed?"

Vyrl scowled at her.

In a quieter voice, Dazza said, "Why

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would an Ironbridge archer try to kill you?"

After a pause, Vyrl answered. "Because of what he saw. It probably looked like I was threatening the other Ironbridge man with his own sword. And I had Kamoj. The archer was defending his partner and Kamoj's honor. Or else he thought like the first one, that Kamoj was committing adultery with me."

"Adultery?" Dazza asked. "With her own husband?"

"Interesting concept, yes?" Vyrl hesitated. "The stagman . . . ?"

"He will live," Dazza said. As relief sped across Vyrl's face, she added, "You damn near killed him. Why did you stab him? He was just trying to recover his weapon."

"Why do you think? Someone shot me. Then this one lunged at me. I reacted in reflex."

"I hadn't realized you knew how to use a sword like that."

He shrugged. "I learned on Lyshriol."

"You trained with swords on your home planet?"

"All highborn boys do there. It's part of the culture."

"It just seems so—" Dazza squinted at him. "Barbaric."

Vyrl scowled. "What, if I crisped him with a laser carbine, that would be civilized? Hell, we could be really civilized and have the *Ascendant* drop an antimatter bomb on Ironbridge."

Dazza didn't answer, and Kamoj could tell Vyrl's words bothered her. She had been prepared to hate Dazza, after what Vyrl had told her this afternoon. Instead she kept remembering Dazza's tears, so uncharacteristic of the craggy colonel, when the doctor realized Vyrl was going to live.

"What I don't understand," Vyrl said, "is why Ironbridge stagmen are prowling around my woods."

Dazza glanced at Kamoj. "Would you feel more comfortable if I told him?"

Kamoj nodded, wondering what Dazza knew.

"Told me what?" Vyrl asked.

"We sent people down to talk with Maxard Argali," she said. "It seems your bride was betrothed to Jax Ironbridge."

Vyrl stared up at Kamoj. Mortified, she averted her eyes.

"Their marriage was arranged years ago," Dazza said. "Apparently Ironbridge is quite fond of her."

Kamoj almost gagged. If Jax was fond of her, she would hate to see how he treated people he didn't like.

Vyrl spoke gently. "Look at me, water sprite." When she met his gaze, he said, "I'm sorry. I should have realized a woman such as yourself would already be spoken for."

She wished she could disappear into the woodwork. Vyrl glanced at Dazza and tilted his head toward the door.

"Uh—ah, yes, well." The colonel stood up. "I have to check in with the *Ascendant*. I'll look in on you later."

When Kamoj and Vyrl were alone, he said, "I truly am sorry. I figured there might be others, but I assumed if something was serious, you would refuse my offer. It didn't occur to me that you would have no choice." After a moment he added, "Or maybe I didn't want it to occur to me."

"You established your bid legally," Kamoj replied. "No one could match it."

"I don't get it," Vyrl said. "How did the concepts of slavery and a dowry get mixed up together here?"

"Slavery? What do you man?"

"Don't you hear what you're saying? I outbid him for you. How can you not hate me?"

"You did nothing wrong."

"I bought another human being. That's wrong. On top of which, it was a woman who had already given her word to another man." Dryly he added, "A woman younger than most of my granddaughters."

Granddaughters? Older than her? Surely she heard wrong.

Then again, Jax was Vyrl's age and he had illegitimate children everywhere,

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some of them adults with their own children. That, she realized, was what bothered her. Not that Vyrl had children but how he came about them. With Jax she had almost managed to convince herself she didn't care what he did. With Vyrl, an agony of jealousy rose in her.

"What's wrong?" he asked.

She stopped massaging his head. "Nothing."

"Something about my children," he said. "Their mother?"

"Men can marry only one woman here. Perhaps in your Imperial court it is different."

He laughed. "Concubines and court intrigue? Gods, Kamoj, that isn't me. I may have more titles than I know what to do with, but I'm still a farm boy from nowhere. All I ever wanted was my wife, my family, and my land."

She spoke with care. "Then you are widowed?"

"I married my childhood sweetheart when we were kids." In a voice soft with sorrow, he added, "Ten years ago she took a fall in the Backbone Mountains. She died instantly."

"Hai," she murmured. "I'm sorry."

"It was a long time ago." His voice gentled. "We had many good years, twelve beautiful children, over forty grandchildren so far, and gods know how many great-grandchildren." He paused, squinting at her. "I get mixed up which of the new ones are grandchildren and which are great-grand. There's even a few great-greats in there."

She stared at him. "But you are so *young*."

"People marry young where I come from. I was fourteen." He laughed. "When I told Dazza that, she nearly went through the wall. Legal age in the overall Imperialate culture is twenty-five, and the average number of children for a conventional couple is two. By the time I was 'legal,' I had six children."

It didn't sound odd to Kamoj. In her experience, people married young and had as many children as possible, with the hope that at least some would survive until adulthood, and perhaps, if the family was lucky, even prosper.

But the numbers and his age still didn't fit. She struggled to work it out. Although she was better at mathematics than most people, she usually had wires with beads to do problems as difficult as this one. No matter how she looked at it, she kept coming up with the same impossible results.

Finally she said, "Even if your children married as young as you did, I don't see how you could have so many descendants, especially great-grandchildren and great-greats."

"Why? I'm sixty-three."

Her mouth fell open. "What? No. That can't be."

"It's true." He grinned. "But if you want to tell me how young I look, I won't object."

She smiled. "You can angle for compliments all you wish, my handsome husband. But I still don't understand. How can you look so young?"

"Good genes and exercise, I suppose. Also, the nanomeds in my body do some repairs, enough to help delay aging." He hesitated. "Did you really mean what you said this afternoon, about wanting me to stay with you?"

"Yes."

"Even though you could have your betrothed back if we arranged for me to 'die'?"

"Jax Ironbridge is a—" The word slug tempted her, but she held it back. No more appropriate word came, though. She kept imagining a slug making its way through the mud.

Vyrl laughed. "You can compare my competition to all the slimy creatures you want."

"I would never speak ill of Ironbridge's good name."

"You're tact is laudable." He closed his eyes. "I like your worm images better, though."

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She stroked his forehead. "Lionstar Province has no worms."

A guilty look passed over his face. "I don't really have a province on this planet."

"Of course you do."

"I do?"

"Argali and our villages." She thought of Azander. "Your stagmen come from outlying hamlets, yes?"

"That's right."

"Most of those hamlets were originally part of the North Sky Islands. But they've become unattached." It appalled Kamoj, actually. Rather than trying to support villages so distant and so impoverished, past governors of the Islands had ignored them, until finally, after many generations, the villages lost all association with their former province—and with that, their last hope of survival. "If their stagmen are your sworn liegemen, then you are also now the authority in their villages."

He opened his eyes. "What does that mean, exactly?"

"A union such as ours is a merger. A business arrangement. In marrying me, you agreed to help support my people."

"In other words, responsibilities come with power."

She took a breath. "Yes."

"Such as?"

"Food. Work. Tools. Shelter." Softly she said, "Survival."

Vyrl considered her. Then he reached out and pressed a turquoise stone on the nightstand.

A voice floated into the air. "Colonel Pacal here."

"Dazza, when is Morlin coming back up?" Vyrl asked.

"I'm not sure. The techs are replacing the fiberoptics. Is there a problem?"

"No. I just need some information."

"Maybe I can help."

He scowled. "Yes, but Morlin never argues with me."

Dryly Dazza said, "What are you about to do that you think will start an argument?"

"Do you remember our decision to minimize interactions with the native culture here?"

"Yes."

"Well, we may have a problem."

"What problem?"

"It seems that by marrying Kamoj, I've set myself up as a sort of sovereign in Argali."

Dazza made an exasperated noise. "That's hardly what I call 'minimizing interactions.'"

"I want to send some techs to the villages."

"Why? The villages have no tech for techs to work on."

"That's the point. These people have a killing winter coming. We can heat their houses."

After a pause, Dazza said, "I'll assign a group to it."

"Discreetly, though. I don't want to scare anyone. Dress them in native clothes and send some of my stagmen with them."

"All right."

"Some of the houses are old enough to have web systems—"

"Vyrl." Her voice had a warning note. "Don't push it."

"Can you go down to Argali too?" he asked.

"Me? Why?"

"See if they need medical help."

Her voice turned dry again. "In case you've forgotten, I'm an ISC colonel. I have responsibilities."

"Oh. Yes. Of course."

The silence stretched out. Finally Dazza said, "I have some residents up on the *Ascendant* who are just out of medical school. They could benefit from the experience."

Vyrl smiled. "Good."

"We should send agriculturists too," she said.

"We already have one." His voice grew animated. "Dazza, listen. I've been working on quad-grains. Give me a few years and I could engineer crops and livestock that would increase production here tenfold."

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"We don't have a few years."

"Just think about it."

She exhaled. "All right."

"Good." Vyrl grinned. Then he yawned and turned his head until his lips touched Kamoj's thigh.

Tears gathered in Kamoj's eyes. Softly she said, "Thank you, beautiful lion."

"Vyrl?" Dazza asked.

"I'm sleeping," he mumbled.

"Ah," the colonel said. "Good-night, Governor Argali."

Kamoj blinked at the phrase. "Good-night?" When no answer came, she said, "Dazza?" The nightstand remained quiet.

So she stroked Vyrl's hair and watched stars move across the patch of sky visible through the window on the other side of the room. Could he truly warm their houses in winter? Heal their ills? Help them grow ten times as much food? It was remarkable how, when life seemed to reach its worst, things could turn about this way. Surely all would be well now.

Surely Vyrl wouldn't drink anymore.

ABOVE THE SKY
Integration

"Water sprite, wake up."

Kamoj moved, then groaned. It felt like pins and thornbats prickled her legs, where she had folded them under her body. She didn't remember sliding out from under Vyrl, but she was sitting next to him now, her hands tucked between her knees. Moonlight poured over the bed.

Vyrl lay watching her. "I need you to do something for me."

She smiled, imagining his hands on her body. "Anything."

"In the second drawer of my desk. There's a bottle I need."

Her good mood vanished. "You don't need that."

"I can't sleep."

"Dazza could give you—"

"No!"

"But—"

"I don't need Dazza's damn sedatives."

"I can't get you the bottle."

His voice hardened. "Why not? You have two legs. You can walk the ten steps it would take to reach the desk."

"The rum hurts you."

"After two days you claim to know me well enough to dictate what is and isn't good for me?"

"Vyrl, no. That's not what I meant."

"Then get it for me." His voice gentled. "Just for tonight. To help me sleep."

"I can't. I-I'm sorry."

His gentleness disappeared. "Then get out of my bed."

"But I—"

"Get out."

Stunned, Kamoj slid off the bed and ran across the room, her bare feet slapping the stone. Inside her chamber, she dropped onto her own bed. Moonlight shone through the window, creating a swath of pale colors across the floor.

A grunt came from the master bedroom, followed by the rustle of blankets. Kamoj froze, listening.

A gasp, labored but brief.

Silence.

Was he having trouble breathing? It was hard to believe he had suffered a collapsed lung only this afternoon. She started to get up, then hesitated. *Get out*, he had said. If she walked in and he was fine, she would look like a fool.

The crash of shattering glass broke the silence. She jumped up and ran into his bedroom.

Vyrl was kneeling by his desk, wearing only his sleep pants, his chest bare, except for the bandages, his arms wrapped around his body. Shards of broken glass covered the floor, glinting in the moonlight. A pool of rum was spreading under the desk.

Kamoj went over and knelt in front of him. Up this close she saw tears on his cheeks, just as she had seen them last

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night after his nightmare. She wondered if his waking helped at all or if his night terrors recognized no boundaries between sleep and reality.

Stretching out his arm, he pulled a strand of her hair away from her lips. "Touch me, Kamoj. Let me feel you. See you. Smell you."

She reached for him. "Always. Whenever you want."

Instead of responding, he grabbed the desk and pulled himself to his feet. The window above the desk looked south, over the Lower Sky Hills that fell away to the plains. Staring out at the mountains, he spoke in a distant voice. "I've a younger brother. Kelric."

She stood up, trying to understand his mood. "A little brother?"

"Little?" He gave a short laugh. "He's huge. Joined ISC."

"Is he here now?"

"No. The war took him away."

Kamoj lifted her hand, meaning to touch him, to offer comfort. Then she hesitated, unsure what he needed or wanted. Uncertain, she dropped her hand again.

"I have a lot of brothers," he continued. "Althor. I always admired him. Looked up to him. He joined ISC too. Jagernaut."

"Jagernaut?"

"Cybernetically enhanced star fighter pilot. Like Kelric. Like those new bodyguards Colonel Pacal gave me."

"Althor is a soldier too?"

"Was." In a wooden voice, he said, "ISC gave him a beautiful funeral."

"Hai, Vyrl. I'm sorry."

He kept on, as if unable to stop. "There's my sister. Soz. We were closest in age, out of ten children." He finally turned to Kamoj. "You look a little like her."

"She is also a soldier? Like Dazza?"

"Dazza served under her."

"Where is she now?"

"Blown to dust."

"Vyrl, I—I'm sorry."

"Sorry?" His words came like leaded rain. "My brother Eldrin is still alive. The Traders captured him. You know what they do when they catch one of us? No, never mind. You don't want to know. My aunt and her son, they're gone. Prisoners, maybe. Dead, probably. Then there is Kurj, my uncle. War leader before Soz. She took over after the Traders killed him."

"I'm so sorry." It sounded useless, saying that over and over. She had lost only her parents and that had torn apart her world. She couldn't imagine what it would be like to lose most of a large family.

He walked away, across the room. Bathed in pale light from the Far Moon and the aurora borealis, he climbed the dais. Then he turned to face her. "I'm a good farmer. You want crops with better yields? Bi-hoxen that can better survive your winters? I can work it out. That's what I wrote my doctorate on, the application of genetic engineering to crop and livestock development. I've had Morlin running DNA simulations here."

"I don't understand what you're trying to tell me," she said.

"Farming." He stood in the moonlight like a statue, the planes of his chest stark in the colorless radiance that filled the room. "I've always loved it. You know where I got that? From my father. He loved the land. And he loved us. His children." His voice broke. "At least I was there when he died."

She went to him then, joining him on the dais. Gently she said, "How did it happen?"

He rubbed his palm over his cheek, seeming surprised to find tears there. "Old age. Old wounds." Dropping his hand, he said, "My father spent his last days with his family, in our family house, on our home world. The Allied military let us have that much."

"Allied?"

"The Allied Worlds of Earth." Bitter now, he said, "They were 'kind' enough to let us live in our own homes. Of

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course, Earth now controls the entire planet where we live."

"Earth? I don't understand."

"I told you this afternoon. Our 'allies' betrayed us. They won't let my family go." In a quieter voice he said, "They believe that without my family to power the Ruby machines, ISC won't risk another war. Earth fears that otherwise my people and the Traders will destroy civilization, the way the Ruby Empire was destroyed, five thousand years ago."

"But if you were their prisoner, how are you here now?"

"None of my family could get off-world."

"But you're *here*."

He looked away from her, out the window across the room. "Do you know what my father's dying wish was? His gruesome dying wish? That his coffin be launched into orbit around the planet."

"Orbit?"

"Above the sky."

"Like the moons?"

"Like the moons. He wanted to be a moon."

"But why? If he valued the land—"

"He loved it. The land. The harvest. The seasons." Vyrl turned back to her. "Going into orbit terrified him."

"But you said he asked to go there."

"That's what he told our jailors." A muscle in his cheek jerked. "We held his true funeral in secret, to do what he told my mother he really wanted. We cremated his body and spread the ashes over his land." He swallowed. "Then my family took his coffin to the starport."

"Why, if he wasn't in it?"

"The Allieds didn't know that. There was a body, one their sensors registered as his."

She stiffened. "No."

He went on, inexorable. "Our family physician on Lyshriol was an ISC agent. He installed an intravenous system inside the coffin to feed me. Made the coffin vacuum tight. So I could breathe. Put in a web system to deceive probes. I weigh more than my father, so he streamlined everything. Same for the web, not because of weight, but to minimize the risk of detection. It didn't even have a voice mod for conversation. He didn't want to use drugs in an unmonitored environment, but finally he agreed to sedate me, so I wouldn't get claustrophobic." His voice cracked. "It would only be for one day, after all."

"They buried you *alive?*"

Flatly he said, "My mother made a heartbroken plea to our jailors. Said she couldn't bear to think of her husband in that cold wasteland. In compassion for the beautiful bereaved widow, they agreed to let an ISC ship recover his casket from space. In honor of his wishes, it would spend one day in orbit, and then ISC would make the pickup." He paused. "By the time I awoke from sedation, I would be safe on the *Ascendant*."

Relief poured over Kamoj. "It was a trick! To get you away from your enemies. And it worked."

"Yes. It worked." His cheek twitched. "With just one little glitch."

"Glitch?"

"An Allied bureaucrat stalled the pickup." In a quiet voice, he added, "No one told my family. The Allieds didn't want to upset them. But minutes after the launch, someone somewhere along the line changed his mind and said they wouldn't give up the body."

Kamoj felt as if her stomach dropped. "No."

"Don't look so grim." He flexed his fist, jerkily opening and closing his hand. "Negotiations to recover the body began even before I woke up."

"You woke up inside the coffin?"

"Yes."

Kamoj tried to imagine it, buried alive, with only a box separating you from the sky and stars, knowing something had gone terribly wrong, that you were *here* when you should have been there, safe and free.

Vyrl swallowed. "Do you know what 'sensory deprivation' means? No sound.

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No sight. No taste. No smell. No weight. After a while I couldn't even feel the inside of the coffin. And my mind—I couldn't—as a telepath, I need to be close to people to pick up anything. My mind opened up, searching for anyone. Anything. *Anything.* I was wide open and there was *nothing.*"

"How long?" she whispered.

The brittle edge of his voice broke. "Thirty-one days. When the team on the *Ascendant* finally got me out, I was screaming, raving insane."

Kamoj had no idea what to say. No words would take away this horror, no touch heal it.

"Don't look so dismayed," he said. "They took care of me. Treated me. Hell, it even helped. To a point." His head jerked. "But the psiber centers in my brain went dead. ISC got their precious Ruby psion, but they broke him in the process. Turned me into a crippled telepath." He swallowed. "Except when I sleep. Then my mind opens up like in the coffin. But this isn't space. People are all around. So I go into telepathic overload. If they isolate me and I can't pick up anything, I start to scream again." Dully he added, "And every time Dazza sedates me, all I can think is that I'll wake up in that coffin."

"There must be some cure—something—"

"The rum deadens my brain. It lets me sleep."

She took his hands. "Surely some other solution exists. Can't Dazza and her people help you?"

"They can all go to hell."

"But—"

His voice hardened. "Two people on the *Ascendant* knew my father's body wasn't in that coffin: the special operations officer assigned to the mission and General Ashman, the ship's commander. They could have ended it any time by revealing that a living man was out there. ISC would have lost me back to the Allieds, but I would have been free from that nightmare." His fists clenched. "They wanted me any way they could get me, and to the hell with my sanity."

"Hai, Vyrl." She thought she understood now, both his pain and the desperation that drove his military to such an extreme. Gently she said, "When did you start to feel thoughts again?"

"With you." With an obvious effort, he relaxed his hands. "You're wide open to me, water sprite. I felt it that day I saw you in the river."

Kamoj remembered Dazza's face when the doctor had realized Vyrl was picking up his bride's thoughts. Joy. Hope. Elation. All signs of a healer whose patient had begun a recovery she feared would never happen.

Vyrl took her hand and climbed onto the bed, drawing her with him. As they lay down together, the quilts enveloped them in billowy cloth, soft from many washings and fragrant with the scent of spice-soap.

She touched his damp cheek. "We have a saying in Argali: 'Tears wash clean the debris of the heart.'"

"I'm not crying." Another tear slid down his cheek. "I never cry. Only children do that."

Kamoj thought of all the tears she had held in over the years. "Maybe children know better than we."

His voice caught. "Ai, water sprite. Something inside me is breaking. I don't know what, only that it's thawing."

"Like ice on a lake in spring."

He pulled her into his arms. "Be my spring, Kamoj."

Night curled around them, quiet and foggy. As they made love, a low-lying cloud seeped in the window. Afterward they lay together, drowsing, their heads together, Vyrl's lips touching her hair.

Some time later he said, "Look. The Lion came up."

Kamoj opened her eyes. The fog in the room had reached as high as his desk, but their view of the window was clear. The Lion constellation was stalking across the sky, his head thrown

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back, his mane flowing in a wind of stars.

"See the star in his front paw?" Vyrl said.

"The yellow one?"

"Yes. That's a sun of my home world. It's why we made up the name Lionstar."

"Lionstar isn't your real name?"

He gave her a guilty look. "It isn't even close."

"What are you called?"

"A lot of nonsense."

"Tell me."

"You don't really want to hear it."

She smiled. "But I do. The whole thing."

"All right. But I warned you." With a grimace, he said, "Prince Havyrl Torcellei Valdor kya Skolia, Sixth Heir, once removed from the line of Pharaoh, born of the Rhon, Fourth Heir to the Web Key, Fifth Heir to the Assembly Key, and Fifth Heir to the Imperator."

Kamoj blinked. "So many names."

He touched her cheek. "And you?"

"Just Kamoj Quanta Argali." It didn't sound nearly so impressive as his.

"Quanta?" He laughed. "Ai, Kamoj, you're a bound quantum resonance."

It relieved her to see his spirits lighten, even if his words were odd. "You think my name means resonance too?"

"Argali refers to a Breit-Wigner scattering resonance. It comes from the Iotic word *akil tz'i*." He paused. "Actually *akil tz'i* originally meant leash. It's used now for resonance. Some people say it derives from a Mayan language, but no one really knows."

Kamoj knew nothing about "Mayan," but she had no doubts about her own language. "Argali means vine rose."

"Not really. It just got mixed up with another Iotic word, *akil tz'usub*, which means vine runner."

Just like that, he took away her entire name and gave her a new one, without even realizing it. "What does 'Mayan' mean?"

He pushed up on his elbow to look at her, as if her appearance could give him a clue to his own past. "My people have tried to determine our origins by comparing our languages to those on Earth. Some similarities exist between classical Iotic and Tzotzil Mayan. Other of our words suggest we came from the Mediterranean or Near East. But no matter how you look at it, none of it makes sense, unless my ancestors were shifted in time as well as space. Our history on Raylicon goes back six thousand years, and at that time no culture on Earth even vaguely resembled that of my ancestors."

"Then how can you be sure about the language?" She shook her head. "Scattering resonance? It makes no sense."

"It's like when you roll bowballs on a table and they bounce off each other." He lay on his side again. "Particles do that too."

"Particles? You mean dust?"

"Smaller. Much smaller. And they can change state."

"What is 'change state'?"

"Deform, spin different ways, that sort of thing."

"This is what 'resonance' means?"

"A resonance is when one ball captures another."

She gave him a skeptical look. "Vyrl, I have never heard of bowballs capturing each other."

He laughed. "Just try to imagine it. The balls don't bounce apart right away. They collide and stick together for a while. That's the resonance."

"Why would my name mean such a thing?"

"I don't know." he admitted. "What are some other common Argali names?"

She thought about it. "Sable for women. Maxard for men."

"Maxard could refer to a maximum. What is your uncle's full name?"

"Maxard Osil Argali."

"Osil means life. Maximum resonance lifetime?"

Kamoj didn't see what sense that made either. "What about Sable?"

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"I don't know about that one. It just means black."

"It is a contraction of *Metastable state.*"

He stared at her. "That can't be coincidence! Metastable state refers to a resonance." He looked inordinately pleased with this strange statement. "You're all named after *scattering* processes. Wait until I tell Drake."

"Drake?"

"The anthropologist on the *Ascendant*. He's been trying to make sense out of the name 'Jax.'"

Kamoj stiffened. "What about Jax?"

"It's actually an acronym. Jks."

"Yes. I know. But Jax is easier to say."

"Jks. They're *quantum numbers.* For a free particle. *J* is angular momentum, *k* is energy, *s* is spin." He snapped his fingers. "Jax Ironbridge is a free particle! Actually, he's one term in the partial wave expansion for a free-particle plane wave."

"Good for him," Kamoj said dourly.

His smile faded. "My sorry. That was insensitive."

Free particle indeed. All she knew about Jax was that she no longer needed to suffer a pendulum of emotions, swinging between fear of his temper and relief for his tenderness. Which was fine with her.

After that they lay in silence, side by side, their heads together. Kamoj was almost asleep when Vyrl made an odd choked sound.

She opened her eyes. "Are you all right?"

He wiped sweat from his forehead. "Yes."

"Shall I get Dazza?"

"No." He pressed the heels of his hands against his temples. "I'll be fine."

"I can rub your head."

He glanced at her. "Yes. Thank you."

Kamoj sat up and took his head into her lap. As she massaged him, his eyes twitched beneath his closed lids. But after only a few moments he said, "Maybe you better not."

"There must be something I can do."

"Get me another bottle. From the kitchen. That one I broke is the last I had up here."

"Please don't—"

His face went stiff, like the precursor to an explosion.

"Wait," Kamoj said. She couldn't bear the thought of his rejecting her again, a second time in one night. But how could she do what he asked?

Then it occurred to her that if she went downstairs, she might find someone who could give her advice. "I'll go to the kitchen."

He relaxed. "Thank you, Kamoj."

She put on her underdress and a robe, and left their bed. As she tied her sash, she crossed to the entrance of the suite, wondering what she would find on the landing outside. Vyrl's new bodyguards, stagmen from the *Ascendant.*

She eased open the outer door, trying to project a confidence she didn't feel. Moonlight filtered onto the landing from a window in the stairwell. The two men posted outside were huge, bigger even than Vyrl. They wore black, with no diskmail, only jackets, pants, and knee boots. Metal bands gleamed on their upper arms, and the leather guards on their wrists glinted with metallic ribbing. Each man also wore a black bulk on his hip, not a sword or dagger, but something else with a handle and snout.

Then Kamoj realized one of the stagmen was a stagwoman. Massive and muscled, she stood taller than most men of Balumil. How did Vyrl's people grow so big?

Both guards were watching her. From their intrigued looks, one would have thought she was some rare, exotic flower instead of an ordinary farm girl.

The man spoke in accented Iotaca. "Can we help you, Governor Argali?"

"I need to go to the kitchen," Kamoj said.

He smiled down at her. "Tell Morlin

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what you need. Then you won't have to walk down there in this cold."

"Isn't Morlin gone?"

"Most of the system is down. But you can use the intercom to page someone in the kitchen."

"I don't wish to bother anyone. But thank you." Self-conscious, Kamoj nodded to them as she would to her uncle's stagmen. Then she started down the stairs. To her relief, neither of the giants tried to accompany her.

No lamps or candles lit the stairwell, but moonlight slanted in through the window slits—white light, which meant more than one moon was up, and probably the aurora as well. She reached the Long Hall on the first floor without seeing anyone. A few lamps burned on the walls, but the corridor was empty. Further down, light slanted out of rooms here and there, on either side.

The first of the lit rooms was empty. In the second, a housemaid was cleaning the floor. Kamoj found Dazza in the third. The colonel was sitting on a sofa, reading an odd book with glowing hieroglyphic symbols on its surface.

Dazza looked up as she entered. "Good evening."

Kamoj hesitated just inside the doorway. "My greetings, Colonel Pacal."

"Did you want to talk to me?" When Kamoj nodded, Dazza closed her book and motioned to a chair by the sofa. "Please. Be comfortable."

Kamoj came in and sat on the edge of the chair.

The colonel smiled. "What is it, child?"

Child? Kamoj stiffened and said nothing.

After a moment Dazza asked, "Have I offended you?"

Kamoj made herself relax. She hadn't come here to bristle at people. "I need your help, ma'am."

"What can I do for you?"

"It's about rum."

Dazza pushed her hand through her hair, mussing the grey curls. "Is it rum? Or someone who drinks it?"

Kamoj twisted her hands in her lap. "He wants me to bring him more."

"Don't do it. Please."

"He will send me away."

"He won't."

"He says he will."

"He doesn't mean it."

"How can you know?"

Dazza's face gentled. "I do believe he's already in love with you."

"He can't be," Kamoj said matter-of-factly. "We don't know each other."

"Apparently it happens this way sometimes, with telepaths."

"Happens?"

"Falling in love."

"Everyone falls in love."

"Not like Vyrl."

"Why is he different?"

Dazza set her book on the couch. "Psions have more neural structures in their brain than other people. Vyrl, especially. He feels everything more. Add in that emotional artistic temperament of his and you get real fire."

Her words surprised Kamoj. Vyrl didn't strike her as emotional, but as capable of deep emotions, which she wouldn't have called the same thing. She liked the way he expressed himself, open and warm, full of dash. She wondered, too, what Dazza meant by artistic temperament.

"Fire?" she asked.

The colonel smiled. "They used to call it 'love at first sight.' That turned out to be a misnomer, though. It's more 'at first thought.'"

Wryly Kamoj said, "We have such a saying. 'Love under the Wild Moon.' It is because this love makes your life chaos."

Dazza gave a rueful laugh. "Yes, I can see that."

"But why 'at first thought?'"

"The fields produced by his brain couple to an unusually large degree with yours. His mind interprets that interaction in a pleasant way." When Kamoj shook her head, Dazza tried again. "The process of thinking creates fields in your

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brain. You can't see them, but they can affect what is nearby."

"Like a magnet?"

Dazza gave her a surprised look. "Well, yes, actually, in a sense. The various fields your cerebrum produces are more complicated and less intense, but the basic idea is the same."

"And Vyrl reacts to mine?"

The doctor nodded. "When people are near each another, the fields interact. Usually the effect is minor, even negligible. But every now and then two people hit a resonance. Combine that with a strong physical attraction and you can get intense emotion in a remarkably short time. Over the long term, it can create an exceptional bond." Dryly she said, "Poets call it a love 'deeper than the sea' or 'wider than the sky.' 'Quantum resonance' may sound less romantic, but it's more accurate."

Kamoj blinked. It sounded like Dazza meant Vyrl's actions were more than a drunken whim, that something special about she, Kamoj, had drawn him to her. It unsettled her to discover just how much she wanted that to be true.

Feeling awkward, she said, "He is also important to me. But each time it seems he will be all right, he wants to drink again. I had thought he would stop."

Softly Dazza said, "I wish it worked that way."

"Can you help?"

"I can treat his withdrawal symptoms. And his craving. But I can't make him want to quit." She spoke in a quiet voice. "I'm trying to reach him. But in the end it must be his choice."

"Can't you give him something to make him stop?"

Dazza shook her head. "I don't think so. I could inject nanomeds that would interact with alcohol to make him sick every time he drinks. But if I force him to quit that way, it won't stick. In the end all I would probably achieve is to earn more of his resentment." She grimaced. "Besides which, if I did it without his consent, I would be breaking the law and endangering ISC relations with the Ruby Dynasty."

Kamoj nodded. She and Maxard had often had to juggle politics with expediency for the sake of Argali. "Vyrl doesn't seem like someone who would drink so much."

"Apparently he never had much interest in it prior to—" The colonel stopped, then said, "to a sickness he suffered."

"He told me about the coffin."

Dazza stared at her. "He *told* you?" When Kamoj nodded, the doctor said, "He's refused to speak of it with anyone else."

"If he can talk to me, can't he stop drinking too?"

"It's not that easy. His body expects it now. Stopping will make him sick."

"You can help him with that."

She nodded. "Yes. But mentally he also depends on it. He thinks he can't survive without it."

"He can."

"Vyrl doesn't believe it." Dazza exhaled. "I wish I could make him see. Few people could survive what happened as well as he has. It's even more remarkable because his being a psion amplified the experience, gods only know how much. Something had to give. I hate what the alcohol is doing to him, but it could have been a lot worse. He hasn't tried to commit suicide. And incredibly, despite everything, he came through it with his mind and personality intact."

"He thinks the rum does that for him."

"Please, Kamoj. Don't give it to him."

She twisted her hands together. "He gets so angry."

"I know. But you must refuse."

"This is easy for you to say. You don't share his bed."

The colonel blinked. "Well, no. I've my own husband."

Kamoj doubted Dazza had ever suffered the humiliation of being banned from her bridal bed. "I am the one who must live with him."

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Dazza spoke carefully. "No one will force you to stay in this marriage if you desire otherwise."

"Your ISC wishes Vyrl and I didn't wed, don't they?"

It was a moment before Dazza answered. "It is true that the marriage complicates an already complicated situation."

"You will all leave here, yes?"

"Yes. Probably soon."

"What happens to me then?"

"The choice to come or stay is yours."

"Is it?" Kamoj made a conscious effort to keep her voice even. "Vyrl has set himself up as the authority in Argali. If he leaves, it will bring great shame to my province." And to her. "Especially given the way he became governor."

"Surely a way exists to let you save face."

Kamoj made an incredulous noise. "More must be saved than 'face.' Argali is *dying*. Why do you think I was betrothed to Ironbridge? Lionstar humiliated Ironbridge, and if Vyrl leaves, he humiliates Argali as well. If I stay here alone, what happens to the merger? To my province? To my line? Unless I am pregnant when Vyrl leaves, I will have no heir. If I am pregnant, and alone, my uncle will feel honor-bound to stay as guardian to the child, as he did for me. If I leave with Vyrl, Maxard will stay to govern Argali. Either way, Maxard cannot marry his lady in the North Sky Islands. Both Argali and the Argali bloodline, one of the oldest in Balumil, will end."

Dazza leaned forward. "Rest assured, Vyrl would never leave you without the full resources of his title and name. And he can return for visits."

"You think politics will play attendance on visits?" Or loneliness? Bitterly Kamoj said, "Perhaps it doesn't matter. If Vyrl goes, Jax Ironbridge will probably seek his place. Vyrl could return to find his wife taken, and his child too, if we have one." She swallowed. "Given the circumstances, I suspect Ironbridge would eliminate the heir of a rival."

The colonel stared at her. "Saints almighty, Kamoj, we would never let that happen. Don't you understand your position? You are a Ruby consort. Do you have any idea what that means?"

"No."

Dazza paused at the blunt response. In a gentler voice, she said, "Your marriage gives you the highest standing a person can have among my people. ISC would never strand you, your family, or your province." She hesitated. "Assuming it is your wish to remain married to Vyrl rather than Ironbridge."

A voice came from behind them. "Colonel Pacal?"

Dazza looked past Kamoj. "Yes?"

Turning, Kamoj saw the *Ascendant* stagwoman in the doorway. "Prince Havyrl wants to know what happened to his wife," the guard said.

"Hai." Kamoj stood up. "I will be right there."

"Governor Argali," Dazza said. When Kamoj turned, the doctor added, "One more moment, if you don't mind."

Kamoj sat down. "Yes, ma'am?"

In a soft voice Dazza said, "Gods know, I may be letting my hope run away from me. But I do believe Vyrl wants to quit." She paused, watching Kamoj. "If he can just make it one day without the rum, it's a start. Don't bring it to him. Please."

Kamoj swallowed. "I will do my best."

Gently the doctor added, "And if he isn't ready to stop, don't blame yourself."

Kamoj nodded. Then she stood and went to Vyrl's bodyguard. The woman bowed, then accompanied Kamoj back to the tower.

Kamoj reentered the suite to find Vyrl sitting on the edge of the bed. He watched as she walked up the dais to him.

"Where is it?" he asked.

She stopped in front of him. "I didn't get it."

"Who were you talking to down there? Dazza?" When Kamoj flushed, his

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voice tightened. "Your laws say you're supposed to do what I tell you, don't they? So get it for me."

"You don't mean that."

"Don't tell me what I mean." He started to get off the bed. "I'll go myself."

"Vyrl, no." Kamoj pushed him back. "You were almost killed today. You shouldn't be up at all." She took his hands. "Listen. I'll rub your head. We can hold each other. Every time you want a drink, we'll make love. So many better ways exist to sooth your demons than soaking them in rum."

Despite himself, his mouth quirked in a smile. "I like your cures a lot better than the ones Dazza comes up with." In a gentler voice he said, "But I don't need this 'cure,' water sprite. It does more damage than what it is meant to fix. If Dazza told you otherwise, she's wrong."

Kamoj lifted his hand and bit at his knuckles in a gesture of affection common throughout the Northern Lands. "Please."

Instead of answering her, he said, "Men do that where I come from." He lifted her hand and kissed her knuckles, pressing his teeth against them. "Like this."

"Only women do it here."

He pulled her to stand between his legs, his arms around her waist. "Women this, men that. All these 'rules' exist and they're different everywhere. Do you know what I think? That under all those rules, people love the same. They find their way to each other no matter what."

She put her arms around him. "I can't bear to see you hurt yourself."

"I just need a drink. It helps. Not hurts."

"It's drowning you."

"That's flaming nonsense, Kamoj. Did Dazza pressure you to do this?"

"No one pressured me. I know what I see."

"Now you're a medical expert?"

"I don't need to be."

He brushed her hair back from her face. "If you won't get it for me, I'll go myself."

"Vyrl, please. It's destroying you."

"How the hell would you know?"

"Cursing at me won't change the truth."

"It's your truth. Not mine."

"You almost *died* today. Because of the rum."

It was a moment before he spoke again. When he did, he surprised her. "I never used to drink. I don't like the taste of it."

"Not even now?"

"Not even now."

"Then don't drink it."

His anger flared. "I can stop if I want."

"Then why don't you?"

"I don't want to."

"So why do you care that you never used to drink?"

"I don't care."

"Then why bring it up?"

"Damn it, Kamoj, let it go."

Her voice caught. "I wish I could make your night-demons go away. But I can't. Neither can the rum." A tear ran down her face. "I don't want you to send me away. But I can't do what you want."

He watched her, his face unreadable. "Don't sound like this."

"Like this?"

"Like your heart is breaking."

"Just one night. Stay away from it for one night."

He didn't answer, just pulled her closer until her head lay against his shoulder. She wasn't sure if he offered affection or couldn't bear to look at her. For a long time they held each other, he sitting, she standing. Gradually she began to hope it would happen, that tonight he would turn from his blue bottle.

He drew back to look at her. "Very well."

Her hope surged. "Yes?"

"I'll send one of my bodyguards for it."

"*No.*"

"If you really wanted to be a good wife, you would help me."

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"I won't help you kill yourself." She squeezed his hands. "You've already made it more than halfway through the night. You only have a few more hours."

His face was set. "If you won't help, I don't want you here."

She felt as if he had slapped her. But she forced out the words. "All right." She let go of him. "I will have my things sent back to Argali. I can leave in the morning."

A muscle in his cheek twitched. Then he turned and stabbed his finger at a jade leaf on the nightstand. Defeat washed over Kamoj, made all the worse by the way her hope had built.

A voice came into the air. "Doctor Pacal here."

Kamoj froze, watching Vyrl. He had an odd startled look, as if he had surprised himself.

After several moments Dazza said, "Vyrl? Is that you?"

"Yes. Never mind. I'm sorry I bothered you."

"Are you all right? Do you have any pain?"

"No."

"You're sure?"

"Yes."

"Vyrl—"

"I'm fine."

"I can come up."

"No."

"Are you certain?"

"Yes. Good-night."

"Call me if you need anything."

"I will."

After a while Vyrl said, "Are you still there?"

"Yes," Dazza said.

"I don't . . . I mean, I'm fine. But I—" He fell silent. Kamoj wondered if Dazza was waiting with the same held breath as she, afraid to speak for fear of saying the wrong thing.

Finally he said, "You can treat withdrawal symptoms from alcohol, can't you?"

Dazza spoke quietly. "Yes. I can help."

"Can you come up here?"

In an infinitely gentle voice she said, "I'm on my way."

Vyrl touched the leaf again. Then he sat staring at the wall. Finally he turned to Kamoj. "Just for the rest of tonight."

Tears pooled in her eyes. "Yes. Tonight." In the morning they would deal with tomorrow, and when the time came, with the day after that, one day at a time.

DRAGON'S BREATH
Rearrangement Collision: Ionization and Recapture

The buzz of a bottle-beetle blended with forest sounds, quetzals calling and wind blowing. The translucent radiance of dawn filled the room. Kamoj's mind gradually sorted out what had awoken her. Someone had said her name.

Turning her head, she saw Vyrl sitting on the bed, dressed in a work shirt and old pants, his hair mussed as if he had been out in the wind.

He leaned over and kissed her. "You're all rumpled and warm under there."

She smiled drowsily. "How long have you been up?"

"A few hours. I had trouble sleeping."

"Did Dazza's medicine help?"

He nodded, still leaning over her, his hands on either side of her shoulders. "I feel like a stardock crane ran over my head, though."

Kamoj touched his cheek. It was the only way she knew to tell him how much it meant to her to see him sober this morning. She feared if she spoke of it, she would disrupt his precarious equilibrium. So instead she said, "What have you been doing?"

"I was down in the old throne room."

"Throne room?"

"Downstairs," Vyrl said. "The hall on the other end of the palace. We haven't finished restoring it yet."

It sounded like he meant the Hall of Audiences. "What are you going to do

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with it?"

He started to answer, then stopped. Sitting up straight, he said, "I'm not sure. I was deciding how to resurface the floor."

"The floor?" Kamoj wondered what he was trying to tell her. She tried to hold back her yawn, but it came anyway. It had taken her hours to doze off again last night, and then her fitful dreams had kept her restless.

"Go on and sleep," Vyrl murmured. "It's barely sunrise. I have to talk to Drake anyway."

Her eyelids drooped. "Drake?"

"Drake Brockson. He's the chief anthropologist on the *Ascendant*. I asked him to put together a summary of his studies on this world."

"What does he say?"

Vyrl hesitated. "He thinks the original population here was breeding stock."

"You mean our animals?" She pulled the covers up around her neck, content in their warmth. "Bi-hawks have two stomachs."

"The animals weren't the primary subjects."

"What was?"

"People."

"Bi-people," she mumbled. "Some people have double stomachs, you know. They can go longer without eating."

Vyrl didn't answer right away, and she had just about fallen asleep when he finally spoke. "Yes. That was the intent."

"Intent?"

"Are you sure you want to know?"

"Hmmmm . . ." Just having Vyrl nearby soothed her. Perhaps Dazza was right, that she and Vyrl had some invisible effect on each other. "Yes . . ."

He spoke in an awkward tone. "Drake thinks your ancestors were engineered to be the ideal slaves."

What? She opened her eyes. "How can he say such a thing?"

"Everything points to it."

"Points how?"

He spoke quietly. "Your people's docility, your drive to please authority, your reluctance to engage in battle or rebellion, your physical beauty and heightened sexual response, your ability to work for long hours in excruciating conditions of climate, atmosphere, poverty, and lack of food—it all fits the models."

She pushed up on her elbow. "It can't be."

"Even your names support it."

"Our names?"

He nodded. "Each line has its talent. Ironbridge produces electrical wizards, like the Ohmstons. Argali has Sunsmiths. By building your expertise into the brain, your creators avoided having to educate you. In fact, they probably designed you to have trouble learning anything else. Smart slaves are dangerous."

It made more sense than Kamoj wanted to admit. Uneasy now, she asked, "And my name? Resonance?" When he hesitated, she said, "I want to know."

Vyrl touched the jeweled chain around her neck. "Human nature prefers freedom. In slaves, that urge must be constrained. Drake believes the Argali line was an experiment designed to create humans less resistant to bondage. The 'resonance' is an allegory. Your creators wanted to increase the lifetime of a metastable bound state."

Kamoj frowned. "And Jax?"

"He probably descends from the owners. The free state. It's unlikely they all managed to leave here when the Ruby Empire collapsed."

Knowing she might have been bred by Jax's ancestors to work herself to exhaustion was enough to make Kamoj that much more determined to sleep. Then it occurred to her that Vyrl had invoked more of their ownership customs than Jax ever did.

He stiffened. "I don't own you."

"Our laws say you do." Kamoj hesitated. "If a man's corporation is larger than the woman can match, she becomes his property. It isn't only marriages. We couldn't match your rent, so we had to give you the palace."

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"A corporation isn't a dowry."

"Then what is it?"

"The word derives from classical Iotic." Vyrl paused. "It means a group that, as a body, has the powers, privileges, and liabilities of an individual. Corporations can buy, sell, and inherit property."

"As you bought me."

He flushed. "I would never consider you my property."

She spoke with care. "It is almost unheard of for a man to offer a governor a dowry she can't match. With such a merger, his authority extends to her entire province. It is the only way, besides inheriting the title, that a person can become governor. That you were already a leader makes it unprecedented as far as I know."

He shook his head. "You're the leader of Argali. I'll help if I can, but you're the one qualified for the job."

Taking a breath, she forged ahead. "Would you sign a contract to verify that arrangement?"

"Of course."

A wave of relief spread over her. She wondered if he had any idea what his answer meant to her. Jax's refusal to sign such a contract was another reason she had delayed the Argali-Ironbridge merger. "I will have a judge prepare the documents."

"All right." He hesitated. "I'll be down at the Ridge."

"You mean the palace tri-grain fields?"

"Yes." Shifting his weight, he added, "I told Jak Tager I would talk to him."

Kamoj remembered the name. Dazza had spoken of Tager during their ride in the giant metal bird. "Is he a doctor?"

"Psychiatrist. A healer of emotions." Vyrl's shoulders tensed under his work shirt. "It can't hurt just to show him a few crop variations I'm working on. I don't have to talk to him again if I don't want to."

"I'm glad, Vyrl." She felt a curious sense of release, as if his words had lifted a weight from her. She let her eyes close.

"Kamoj?"

She opened her eyes half-way. "Yes?"

"This morning I went riding with my bodyguards. We saw some people practicing folk dances in the village."

She yawned. "Probably rehearsing for the harvest festival."

"Some were men."

Her eyes closed again. "Men do the Reel of the Greenglass Stags. They stamp their boots a lot in that one. In the Sun Lizard's March they spin torches in the air. And they do partner dances with the women . . ."

She was almost asleep when Vyrl said, "Then it is accepted for men to dance here?"

With a sigh, she tried to wake up. "Of course. Why?"

"I just wondered." Leaning over, he kissed her. "Sleep well, water sprite."

As Vyrl's footsteps receded across the room, she drifted into the downy embrace of sleep.

A smell of burning scales woke Kamoj. The early morning sunlight had a dirty cast to it. When she widened her nostrils, she almost gagged on the stench of ashes. She slid out of bed and ran to the south-facing window.

To her left, the East Sky Mountains towered in forest-carpeted peaks. Before her, the Lower Sky Mountains spread out in fields and then fell away in wooded hills to the distant flat lands, where villages dotted the aqua-blue plains and rivers criss-crossed the land in silver threads. To the west, the Argali Mountains descended in great wrinkles until, out of sight, they reached the village of Argali.

The mountains roared in flames.

Forest fires blazed in the Argali and Lower Sky Mountains. Billows of smoke rose from peak after rolling peak, and tongues of dragon's breath threatened the flat lands. If the outlying hamlets of Argali weren't already burning, they would be soon—and then Argali itself.

The floor under her feet vibrated. A

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giant bird of gold and black metal roared over the tower, shaking the building with its passage. It arrowed south, where other birds soared over the fires, their metal plumage aglitter in the sunlight. One released a purple cloud that billowed across the flames. The burning orange tongues cowered, beaten back, then flared anew, relentless in their advance.

"Sweet Saints," Kamoj muttered. Why had no one woken her up? She had to get out there to help. She had no doubt Vyrl's first reaction had also been to join the firelines. Was he out there now, or had the *Ascendant* ordered his return to its fortress above the sky, forcing him to safety against his will?

Kamoj ran into her chamber, to the rose cabinet where she stored her clothes. As she paused to open it, she saw herself in the mirror, a young woman with a wild mane of black curls that poured down to her hips. She wore only a translucent underdress, her nipples outlined against the pink silk. Rubies and gold glittered at her neck, wrists, and ankles. Collar and cuffs? Was that the origin of these family heirlooms? She gritted her teeth, knowing she would never see her wedding jewels the same way again.

Metal clinked on stone in the master bedroom.

"Vyrl?" Kamoj went back to the bedroom, to see if he had news. The suite, however, was still empty. She checked the landing outside, leaving the foyer doors open, but found no one there either.

Inside the suite, she heard metal scrape stone again.

Puzzled, Kamoj went back into the bedroom. Still she saw no one. She walked to the window—

And froze.

An iron tri-hook gripped the sill like a huge dragon's claw, piercing the shimmer curtain. Even as Kamoj watched, a hand came over the sill and slapped onto the wood. Then a woman pulled herself up into view, a husky archer dressed in Ironbridge colors. She hauled herself up onto the sill in one smooth motion.

Kamoj wasted no time on questions: she spun around and *ran.* As she raced out onto the landing, she heard boots thud on the floor in the suite. She ran down the tower stairs, her bare feet slapping the steps. Why hadn't Morlin warned her of the intruder? Was he still "down," whatever that meant?

At the bottom of the stairs, the door to the Long Hall was jammed open by the body of an elderly butler who had probably been coming to warn her about the fires. When she saw the gash in his head, she dropped to his side. Mercifully, he still breathed, unconscious but alive.

The sounds of pursuit grew louder above her, boots pounding on stone in the stairwell. Kamoj scrambled over the butler and ran down the Long Hall. She couldn't outfight or outrun the archer, who had both height and body mass over her, but she knew these mountains far better than Jax's people. As soon as she made it outside, she would easily lose her pursuer in the forest.

Bodies lay in the hall up ahead, two maize-girls, bound and gagged. For a instant Kamoj feared they were dead. Then she realized no point existed in binding or gagging dead people.

Far up the corridor, near the maize-girls, an Ironbridge stagman stepped out from a doorway.

"Hai!" Kamoj skidded to a stop. Whirling around, she saw the archer striding toward her from the other direction, the woman's long legs covering ground fast. Kamoj ran straight at her, trying to reach the nearest doorway before the archer reached her. She made it and ran into a sitting room filled with gold and white furniture. Bronzed sunlight poured through its floor-to-ceiling windows, the promise of escape. She raced toward them—

Someone grabbed her around the

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waist. As Kamoj yelled, the archer swung her around, lifting her feet off the floor. Half-carrying, half-dragging Kamoj, the woman strode back into the Long Hall, where the stagman met them. When Kamoj tried to shout for help, the stagman shoved a sponge in her mouth and tied a gag around her head, while the archer held her arms pinned. Then her captors each grabbed one of her upper arms and took off, forcing her to run between them or be dragged.

In seconds they were outside, racing across the courtyard. A cart waited for them, hitched to four blueglass bi-hoxen, bulky six-legged mammoths with sparks of sunlight flashing off their scales. The stagman climbed onto the driver's seat, a plank of wood set across the front of the cart. Kamoj caught only a glimpse of his actions, being otherwise occupied in her struggles with the archer. The woman hefted Kamoj up and threw her into the back of the cart, between two rolls of carpet, by a coil of rope. As she vaulted in after Kamoj, the cart jolted into motion. Kamoj tried to scramble out of it, but the archer shoved her back down on her back.

The stagman looked around, the reins of the bi-hoxen gripped in his hands. "Tera, keep her still."

Tera, apparently the archer, just grunted as she and Kamoj wrestled. Kamoj raked her fingernails across Tera's arm, drawing blood. Then the archer flipped her onto her stomach and yanked her arms behind her back. Kneeling on Kamoj's legs, she bound her prisoner's wrists together with the rope.

The bi-hoxen plodded on, oblivious to the struggle, pulling the cart up into the North Sky Mountains.

Ancient trees towered over the path, clogged with moss and Argali vines. Black-scaled thornbats hissed among the foliage, searching for puffs to skewer with their needled beaks. Their high-pitched cries echoed in the hoary forest. Except for the rare Argali rose or puff lizard, the trees hunkered in dark hues, their scaled iridescence subdued by the weather. A misty drizzle was falling, mixed with fog that glinted from the scale dust suspended in it.

The cart rolled on, jolting up the narrow path, crushing vines and roses under its wheels. Tera sat next to Kamoj, as she had throughout the ride, silent, watching her captive. Bound and gagged, Kamoj had shivered at the start of the trip, until Tera wrapped a carpet around her shoulders.

Kamoj glanced at the boda-bag on Tera's belt. She had neither eaten nor had anything to drink since yesterday.

For a while Tera watched Kamoj watching the boda-bag. Then the archer spoke, her Ironbridge dialect so strong Kamoj could barely understand her. It sounded like, "Be you still o'piece, move I yer quieter?"

Kamoj nodded, hoping she had guessed the correct meaning of the question: *will you be quiet if I take off the gag?*

Tera removed the gag, then pulled the sponge out of Kamoj's mouth. The archer took the boda-bag off her belt and unscrewed the top. Tilting its narrowed end to Kamoj's lips, she squeezed the bag, making wine squirt into Kamoj's mouth. As much as Kamoj disliked the harsh mead brewed in Ironbridge, she disliked her searing thirst even more. She sucked the bag dry.

When Tera lowered the bag, Kamoj said, "Will you untie me?"

The driver answered, what sounded like, "Maybe a'can," to which Tera responded, "Lector, we cannee risk her a'run." Kamoj wasn't sure if *Lector* was an oath or the driver's name; either way, it came from a contraction of *Electromotive Force*. Legends painted Lector as a great hero who converted humans into energy. Why converting people into energy was heroic, Kamoj had no clue, but the name was popular in Ironbridge.

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"I won't try to run," Kamoj said. She almost meant it; she had no idea where they were now, besides which, she would be even colder wandering in the woods than sitting here under a carpet. Even so, she was willing to try an escape.

She didn't fool Tera, though. The archer made no move to untie her. "Out there you be peat for Argali vines," she said.

"Look," Lector said. "That wild greenglass again. I'd spend a Long Year to catch that beaut."

Kamoj looked, and saw a huge stag keeping pace with them, half-hidden in the trees. She doubted Lector would have success with this greenglass. Greypoint would never allow anyone but Vyrl to ride him. And it was Greypoint following them, she was certain. But why? The Current only knew what the animal had thought yesterday when a giant metal bird took away Vyrl. Had Greypoint been pacing the woods since then, undecided whether or not to return the Quartz Palace?

Tera was watching her. "The animal follows you." She grinned, showing teeth browned from chewing cabarque leaves. "We caught us a forest nymph guarded by the king of stags, heh?" Her smile faded. "Or else we caught us a witch."

"Donnee talk of Argali that way," Lector said.

Tera answered something about, "vile business" and "Lionstar," to which Lector nodded in agreement.

Their words were an unwelcome reminder to Kamoj of Vyrl's dismal reputation. No one had trusted him before and now he had trampled their customs. All in the Northern Lands would have the same thought: if a stranger could overthrow Argali and humiliate even Ironbridge, no one was safe. Jax must have marshalled that fear to augment his army, bringing in archers like Tera who usually served on a highborn woman's bodyguard. He would have left enough archers and stagmen to protect Ironbridge and taken the rest with him. While Vyrl rode on Ironbridge, Jax was somewhere up here, high in the mountains, sealing his plans for Argali.

As the bi-hoxen plodded onward, Kamoj brooded. Would the *Ascendant* help Vyrl find her? *Could* they find her? She had no concept of what the *Ascendant* could do, no referent to understand either it or its people. Besides, either Lector or Tera would go back and hide their tracks. Probably Tera. She had a venerable name, one that originally derived from the Volterra line in Argali, though the Volterra penchant for travel had long ago spread it across the Northern Lands. Volterras had a knack for solving problems that involved a preferred direction. They made good trackers.

Groggy from hunger and drunk from mead, Kamoj fell into a daze, watching the trees go by. The cart finally rolled into a high mountain clearing. Saturated in mist, a camp lay before them, black tents with purple tassels hanging from their roofs. Stagmen moved about the clearing, cutting wood, mending clothes, cleaning weapons, tending campfires. They all wore boots and fur-lined clothes, protection against the sleet that drizzled from the overcast sky.

When Tera tugged the carpet off Kamoj, a blast of freezing air cut through Kamoj's underdress to her skin. Then Tera pulled her out of the cart. As Kamoj's bare feet hit the iced ground, she gasped and jerked. With her hands tied behind her back, she lost her balance and fell against the cart.

Lector came over to her. He lifted Kamoj up, settled her in his arms, and then set off into the camp, carrying her with one arm under her knees and the other behind her back. She gritted her teeth against the stares of the encamped army. Her rose-hued dress was the only bright color in the camp, and she knew glimsilk glowed on overcast days. It was like a beacon drawing attention to her loss of status. Jax had stripped her of au-

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thority in both a literal and figurative sense.

Lector stopped at a large violet pavilion with black tassels hanging from its fringed roof. When he nodded to the two stagmen posted outside its entrance, the taller man inclined his head and went inside the tent. Kamoj was shivering uncontrollably now, her dress frozen in the sleeting rain.

The flap lifted, releasing a puff of warm air. The stagman looked out at them. "He meets with an advisor now. He be calling you when they finish."

Kamoj stared at him. Did Jax mean to freeze her?

"Sweet saints, man," Lector said. "She cannee survive this cold."

Another stagman inside lifted the flap, releasing more warm air. "You may come now," he said.

As Lector carried Kamoj into the tent, warmth closed around her. She closed her eyes, hating herself for the gratitude she felt. Did Jax plan these things, or did he just have an inborn instinct for controlling people?

Silk panels hung on the walls, violet, silver, and black for Ironbridge. Rugs covered on the ground and a bed made up with purple velvet stood in one corner. On the floor, braziers with iron grates gave out heat that rippled in waves, distorting the air above the scrolled grills.

"Over there," a man said. *That* voice Kamoj knew. Jax. Looking over her shoulder, she saw him sitting with a judge at a table across the tent. He returned to his meeting without acknowledging her.

Lector set her on a pile of furred blankets near a brazier. As he covered her with the furs, she craned her neck to look at Jax again. Unexpectedly, he was watching her. When he realized she had caught him doing it, he turned away, focusing on his advisor, who was struggling to decipher a map.

Heat from the brazier warmed Kamoj, melting the ice on her clothes. She began to feel again: rivulets of water ran down her neck from her hair, Lector's jacket scratched the skin of her arms, and waterproofed fur rubbed her thighs. Closing her eyes, she soaked in the warmth. She knew she was passing out but she didn't care. Exhausted, she let darkness carry her into oblivion.■

To be concluded in the next issue

The Quantum Rose *takes place in the same universe as Catherine Asaro's* Analog *stories "Aurora in Four Voices" (December 1998) and "Light and Shadow" (April 1994), and her Skolian Empire books from Tor. In chronology,* The Quantum Rose *takes place about one year after the book* The Radiant Seas.

The world's battlefields have been in the heart chiefly; more heroism has been displayed in the household and the closet, than on the most memorable battlefields of hisory.

—Henry Ward Beecher

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Blue Light, Walter Mosley, Little, Brown, $23, 296 pp. (ISBN: 0-316-57098-2).

Red Shadows, Yvonne Navarro, Bantam, $6.50, 401 pp. (ISBN: 0-553-57749-2).

Rainbow Mars, Larry Niven, TOR, $24.95, 316 pp. (ISBN: 0-312-86777-8).

Not Exactly the Three Musketeers, Joel Rosenberg, TOR, $23.95, 315 pp. (ISBN: 0-312-85782-9).

Trapdoor to Heaven, Lesley Choyce, Quarry Press (P.O. Box 1061, Kingston, Ontario K7L4Y5 Canada), $16.95 (Canadian), 218 pp. (ISBN: 1-55082-157-1).

Ahmed and the Oblivion Machines: A Fable, Ray Bradbury, Avon, $14, 62 pp. (ISBN: 0-380-97704-4).

For the Emperor, Christine W. Murphy, Hard Shell Word Factory (http://www.hard-shell.com), $3 download, $4.50 disk, 200 pp. (ISBN: 1-58200-026-3).

Science-Fiction: The Gernsback Years, Everett F. Bleiler, with the assistance of Richard J. Bleiler, Kent State University Press, $65, xxxii + 731 pp. (ISBN: 0-87338-604-3).

Lovecraft Remembered, Peter Cannon, ed., Arkham House (P.O. Box 546, Sauk City, WI 53583), $29.95, 486 + xiv pp. (ISBN: 0-87054-173-0).

From Blood to Water, Damien Filer, CICA Publishing (4820 Lotus Street, San Diego, CA 92107), $19.95 (ISBN: 0-9661231-0-7).

We have a curiously colorful trio to lead off this month's column. Blue, red, and rainbow. Sheer coincidence, of course, but not so sheer that it appeals to the emperor's tailor. That's right, the emperor is here too, as well as the dowager empress and a little something with the feel of fairy tale. But enough of the silly introduction. Let's get this show on the road . . .

Walter Mosley's **Blue Light** doesn't have anything to do with the specials at K-Mart. Nor with cops, even though Mosley is the author of the popular Easy Rawlins mystery series. In fact, if we must draw comparisons with anything at all, we should surely look to Philip K. Dick's pink light, a beam of which delivered gnostic illumination in *Valis* (reviewed here in April 1981). Yet Mosley's blue light is more than mere illumination.

As his tale begins in the mid-1960s, a thousand thousand needles of blue light emanate from Neptune, aiming toward the sun and inner planets, seeking "the seed left on Earth eons before and, hopefully, grown to stature." The needles of light, a dozen light seconds long, encode the memories and natures of beings from the far reaches of the cosmos, and when they strike an Earthly bug or tree or coyote or human being, they transfer that information and raise the organism far above its customary station.

Alas, the needles cannot guide their

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own flight. They are blind, striking whatever they strike, and here is Claudia Zimmerman, caught in an act of love; she will become Claudia Heart, a goddess of love. Here is Winch Fargo, petty criminal; the light burns him out, renders him pathetic. Here is Horace LaFontaine, dying of cancer in the very moment of his illumination; he will become Death, the Gray Man. William T. Portman, a.k.a. Ordé, homeless pseudophilosopher, will become a prophet of human incompleteness and blue potentialities, found a cult, and strive to spread his blueness by having his acolytes drink a preparation made from his blood. Lester Foote, a.k.a. Chance, suicidal, insane, will survive the dose to become the cult's recording angel, while Miles Barber, a detective investigating the deaths of the other drinkers, lurks suspiciously around the cult's edges. Hidalgo Quinones, gardener, will become Juan Thrombone, a fosterer of singing firs and bellowing sequoias, creator of a haven for the blues who survive Death's assault on Ordé's cult—at least until Death returns.

The characters are largely poses here, unified mostly by their roots in the underclasses of race, poverty, and insanity, but that hardly matters. The mode is mythic, larger than life, more than a little Dickian, and well worth your attention.

Unfortunately, the book's message doesn't really have much to do with the cover blurb, which touts the blues as "precursors of a new race of humans . . . destined to supplant" the old. It is clear that the blues have great difficulty in breeding, either with each other or with non-blues. It is also clear—indeed, essential to the story—that their own Death stalks them with such a mighty hand that they may vanish utterly without normals having more than the merest suspicion of their existence.

And perhaps here is Mosley's real message: He often writes of race, identity, and humanity. Here he seems to be saying that a set-aside group can be full of strange and wonderful potentials that—thanks to threats as much or more from within the group as from outside—may never be realized.

Yvonne Navarro's **Red Shadows** is a cracking good story which anyone who knows much biology will have to struggle to read.

Here's the background, which was developed in an earlier novel (*Final Impact*): In the year 2000, a rogue planet the size of the Moon passed close by Jupiter, whose gravitational tug fractured it into hundreds of pieces which then proceeded to pummel the Earth until the planet's rotation stopped, leaving the American Midwest divided among the Light, Gray, and Dark zones. Civilization thoroughly collapsed, but—miraculously, under the circumstances—there were survivors. Some of them had strange talents, such as psychic healing and mind-reading; that's bushwah, but it's acceptable bushwah given the traditions of fantasy. Some promptly mutated into, for instance, chameleon people who can blend into any environment. And that's not acceptable. Mutations affect one's offspring, and they don't produce new and marvelous features overnight even then. They take generations to be refined by the forces of natural selection.

So here's *Red Shadows*, a mere two decades after the catastrophe, and anyone who understands a bit of biology wants to pitch it across the room as soon as he encounters the chameleon folk, the vampires, the . . . . Well, those are the worst of it. The others could be just behavioral adaptations to extreme circumstances. If one just grumbles and refrains from pitching long enough to get to know a few of the characters—the son in search of his vampire mother, the father hunting down the son who has developed a taste for sadistic murder, the boy who craves adventure and heads for Columbus despite rumors of

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plague, the chameleon girl who leaves town to go exploring, and more—one finds a very appealing world. And when that boy brings the plague known as Red Shadows home, when that son finds his mother and is grabbed for food but escapes with the rest of the imprisoned feeders, when that girl rescues son and feeders from the murderous Vigilantes, one is thoroughly hooked.

The tale is centered in Jacksontown. When the plague arrives, there begins a struggle to understand and defeat it. That struggle seems hopeless until a call for help brings a young healer and a mindreader, brother and sister, from another town. They help, they even find a serum, but all they can do is not enough, until . . . .

The various wanderers all prove essential to the struggle, as do a number of characters from the previous novel. Here the biology is sounder and there is less to interfere with the suspension of disbelief. One comes to the end with a sense of considerable satisfaction.

But I do wish Navarro had set her story a few centuries after the disaster. That would have made her mutants much more believable!

Many years ago, Larry Niven wrote a handful of stories about Hanville Svetz, who had to keep hieing off into the past to fetch home curiosities for the UN's secretary-general, the hereditary ruler of a badly damaged and species-depleted Earth. He went for a horse, a snake, an ostrich, a Gila monster, an elephant, a wolf. But the time machine had a way of jumping the tracks into parallel universes, and he came back with a unicorn, a dragon, a quetzalcoatl, a werewolf . . . . You get the idea: The best laid plans gang thoroughly agley, and the reader is thoroughly amused.

Now there's a new secretary-general. The line's pretty inbred, and he's not too bright, but he's the boss. And he doesn't care about extinct critters. He wants aliens.

Unfortunately, the Space Bureau has been smoke and mirrors for centuries. Fortunately, the time machine does jump tracks, once upon a time there were canals on Mars, or people thought there were, and . . .

Yup. Lowell was right. So were Burroughs and Wells and Weinbaum and Bradbury. Mars is *full* of aliens. Multiple colors, armor, swords, eggs, tentacled brains, and so on. There is also a "hangtree," a biological space elevator that promptly stimulates Svetz and his female crew to go seed hunting in hope of bringing a similar highway-to-space to Earth. They're a bit slow on the pickup, for they miss the connection between certain essential features of living things and Mars's later dessication, but perhaps that's why things go so quickly wrong. Svetz is captured by the aliens, escapes, rescues the ladies, and finally makes it home only to find that he has brought disaster with him. He has also created the legend of Jack and the Beanstalk, and in this is the answer to the disaster.

Rainbow Mars isn't a long novel, but it's a very enjoyable one—Niven has been making reviewers say such things for a long time!—and the final third of the book, consisting of the five older Hanville Svetz yarns and an afterword, makes a very nice dessert.

Joel Rosenberg's Guardians of the Flame universe—a medievaloid place into which both modernity and Faerie intrude and hence where New Pittsburgh makes steel and a telepathic dragon aids war—has proven quite popular. It should thus come as no surprise to find him starting a new series of adventures for his fans.

Herewith, then, **Not Exactly the Three Musketeers**, in which the conniving dowager empress Beralyn Furnael collars three soldiers of the Cullinane barony, the companions Pirojil (who refuses to speak of his long-vanished childhood), Durine (who likes to rob robbers), and Kethol (who is good at

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gambling), and assigns them a mission she hopes will help discredit the Cullinane heroes. Pirojil, Durine, and Kethol are a grumpy lot, but they know how to come to the aid of a maiden in distress, get each other out of jail, watch each other's backs, and recruit a scampish apprentice wizard named Erenor who has a talent for disguise. When they reach their destination, they find no apparent problems, collect the maiden whose complaint of forced marriage to Baroness Ellanee's son Miron is the pretext for the mission, discover a suspicious sign or two (such as surreptitious activity around a largish cave mouth), and head homeward into the teeth of ambush and intrigue.

Our Heroes are very good at muddling through. Just simple fellows, really, with a knack for seeing through a smokescreen and poking a swordtip into the heart of the matter. Otherwise, politics is all. The Cullinanes just want to be left alone—why, they've even forsworn all claims to the imperial throne!—but the dowager empress doesn't trust them a bit. After all, they have Walter Slovotsky, New Pittsburgh, the dragon, and some very loyal retainers such as the Three Non-Musketeers. So she's doing her durnedest to ensure her son's stability on the throne, at least long enough for him to marry and beget an heir. The baroness Ellanee dreams of cutting herself a slice of the empire, and she's nurturing just the thing she needs to do it. At least until Our Heroes show up.

And when the dust settles, stability reigns. At least for a while, though Beralyn and Ellanee are still around and it seems a fair bet that they will shortly be putting their heads together to hatch the scheme that will drive the series' next volume.

Born in New Jersey, Lesley Choyce has become a Nova Scotia writer, publisher of Pottersfield Press, Canada's national surfing champion, a lyricist and guitarist, TV talk show host, and more. He sounds like an interesting fellow, and his fiction doesn't alter that impression a bit.

Trapdoor to Heaven is a novel of sorts. There is an overall structure that loosely holds the parts—fragments that might as easily have been published as short stories (and perhaps they were, though there is nothing in the book to say). Choyce opens with the last human, the "servant," who is not quite human, for he draws energy from the fading sun to melt beach sand which he then spins into thread and casts into the sky, where the wind makes it sing. As he spins, the sun fades, the sea rises, and a multitude of voices within the servant each clamor to be remembered, given voice, restored to a kind of life.

So we meet one who might have lived in the days of the whalers; a baker who, egged on by angels, leads street children away from persecution; a researcher who struggles to perfect cryonics; a woman protesting against the Children's Crusade, and many more. The theme is the human search for peace and purpose, for closure, in the face of the equally human drive for assertion, to be, to be remembered. And at the end, it is hardly certain which half of the opposition triumphs, only that the servant, who has gathered and holds within himself all the reincarnated lives of humanity, remains.

Choyce shows himself to be a poet of the human soul who deserves attention far beyond Canada's borders.

Ray Bradbury's latest is a slim little thing touted as "A wondrous fable for children of all ages." I'm not sure that's entirely true—for instance, I don't think it would speak all that well to anyone under the age of, say, eight or ten—but **Ahmed and the Oblivion Machines** is certainly a fable, it's not written to appeal to old-fart adult minds, and it's likely to be remembered fondly by anyone who first encounters it in youth, which makes it quite wondrous enough.

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The tale begins on "the night following the day when the seagull was seen over the desert." Ahmed, son of Ahmed, falls off his camel while goggling at the stars in the sky and is buried in the sand while the caravan moves on. Abandoned and bereft, he waters the sand with his tears and awakens the ancient god, Gonn-ben-Allah, Keeper of the Ghosts of the Lost Names. Soon Gonn is showing Ahmed the glories of flight that once were and ever will be, encouraging him to soar on the wings of dreams, and warning him that if he clutches after the mundane—that lost caravan and father, for instance—the dreams will die and he will crash like Icarus. Far, far better it is for a boy who just wants people out of bed to soar with the angels, for there lies the mightiness of the world.

"Dream on!" cries Bradbury. "And be glorious!"

The Hard Shell Word Factory is an online publisher in several genres, and it's worth a look (http://www.hardshell.com), judging from the novel author Christine W. Murphy sent me. Her **For the Emperor** is a perfectly acceptable story. Its caliber is not exceptional, but its biggest problem is that it badly needs editing. If you can slide past the occasional spelling problems and jumbled paragraphs, you will find a nice romantic thriller. It begins with heroine Jameelah, attending the Emperor's wedding reception to plant a smoke bomb to call attention to the plight of her oppressed minority group. She is promptly distracted by a handsome stranger in the uniform of the Triden military, spends the evening dancing with him, plants her bomb, and is a mite surprised when it goes "BOOM!" instead of "poof!"

The domineering male terrorist promptly bundles her into an escape pod with the handsome stranger with orders to learn his identity, sneers mightily, and exits left. It doesn't take long for the reader to learn that the handsome stranger is actually the emperor's half brother and a handsome prize for the terrorists if they ever learn who he is. Nor does it take long for the emotional atmosphere to get very thick and steamy, with plenty of bouncing between the personal and the political/ideological to feed the characters' frustration level.

There's more, of course. This kind of novel exists for the complications and setbacks on the way to the predictable ending. But that's the gist of it, and it may well appeal to romance fans.

The new Bleiler book—**Science-Fiction: The Gernsback Years**—is out, and it looks to be an invaluable reference for those who wish to know more about the first eleven years of the science fiction genre, after its "official" establishment by Hugo Gernsback in 1926 (the pre-Gernsback period was covered in *Science-Fiction: The Early Years* [briefly reviewed here in October 1991]). You will find here motif, title, and author indices. Perhaps of more interest to most people, there are brief summaries of all the stories published in the magazines of the period (including Gernsback's *Amazing* and the early *Astounding*), notes on how story content correlates with current events, histories of the magazines, biographical details on the writers (including not only the usual suspects but also a horde of unknowns, with biographical assistance from "First Fandom, an amiable group of coelacanths" [i.e., living fossils]), and a special section (with illustrations) on the five artists—Wesso, Paul, Morey, Brown, and Dold—"who fixed science-fictional iconography during the period."

Also of special interest is Bleiler's attempt in his introduction to describe the readers in terms of the advertisements featured in the magazines. The attempt is imperfect—he says so himself—but telling. It is also not terribly complimentary until Bleiler conspicuously notes the number of major figures in world

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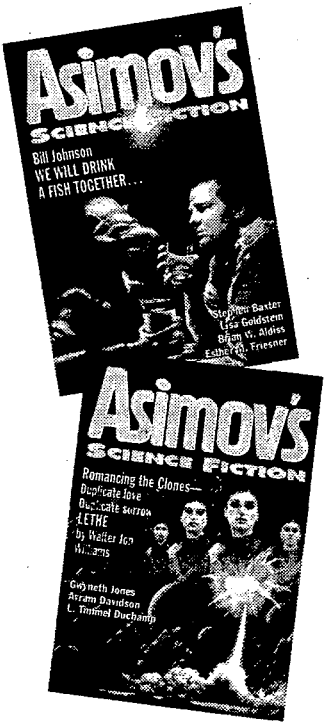

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science and literature who later emerged from the period's small corps of about a hundred die-hard fans (the proportion is such as to leave a Harvard in the dust).

In the 1920s and 1930s, H. P. Lovecraft made a huge impression on the fans of the primitive fantasy of the time. He created an entire genre of dark gods beyond the familiar boundaries of the space and time we know, soaked in eldritch ichor, monsters who mean no good to the human fools who stumble upon their secrets. He was also a prolific letter writer who acquired a vast number of correspondence friends among both fans and amateur and professional writers, and when he died in 1937, there began a flood of reminiscences and tributes attesting to his genius and his impact upon a host of lives.

Today, he seems less impressive. He has been so widely imitated and parodied that he seems little more than an imitation or parody himself. Nor is eldritch ichor much to the modern taste. But his impact was real, and in **Lovecraft Remembered**, Lovecraft scholar Peter Cannon has gathered "the shorter reminiscences, the raw materials that add up to a kind of collective biography. Some pieces are slight or banal . . . . Some contain errors . . . ." But they add up to an impressive mass memory.

It is worth noting that Arkham House was initially founded to perpetuate Lovecraft's opus. It now has a broader focus, for it periodically brings out significant one-author collections in addition to Lovecraftiana.

According to the label, **From Blood to Water** contains a collection of short stories by one Damien Filer, with music and illustrations by Max Springer.

But it doesn't deliver. Find the instructions and activate the appropriate file with your computer, and you will listen to a tinkly guitar until you give up. No menu, no illustrations, no stories, and you can't do anything else while you're waiting because it freezes your system while it's playing. Try to turn it off, and it won't quit. You need to use ctrl-alt-delete.

And then you want a woodstove to burn the silly thing. Except you shouldn't since CDs are made of plastic.

Bah.■

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BRASS TACKS

Dear Stan,

One of my parishioners shared with me your Editorial "Haste Makes Waste" in the January 1999 *Analog Science Fiction And Fact*. Right on!

Some of the ideas you developed brought to mind what Abraham Joshua Heschel wrote about Sabbath and time in his book *The Sabbath*. Heschel was a philosopher/theologian—where you fit on this spectrum I cannot say, but the issues you address and where you lead your reader puts you somewhere on the continuum. He's good company to keep, by the way. One of the best!

LAWRENCE DOWNING
PASTOR

Dear Dr. Schmidt,

I read with amusement some of the responses to your editorial, "King of the Hill." I mainly want to reply to the technological part of the debate.

So a computer can beat a chess-master at chess, or a computer can compose music in the same style as Bach. That's nice, but does that mean that these computer programs are at all intelligent? I'm sure that a chess-master can learn how to play "Chopsticks" on a piano, or that Bach, if he didn't know already, could have learned to play chess to some degree or another. But a chess-playing computer program would have a hard time trying to compose music or vice-versa.

Why do computer scientists keep insisting on focusing on just one aspect of intelligence or another like that? Of course, there are some programmers who really are trying to build computers or computer programs having "brains" that work like the human brain. But why haven't they suceeded? What are they missing?

It could be that they're missing the heart, the lungs, the arms, legs, eyes, etc. Human beings aren't disembodied brains with mouths that sit there and think and talk to one other all day. Why should we expect a computer to be like that? Why do all the computer scientists seem to insist on creating only half an organism, or less than half?

For that matter, why are they trying to start at the top? Anyone who believes in evolution knows that human intelligence had to evolve from lower intelligence.

Why do these programs always seem to be all by themselves? Why don't they have a virtual environment to interact with? Why don't they have other programs to interact with? (*interact*, not compete!) You probably wouldn't come up with anything very intelligent to say either if you lived in a void, or only had one other entity to communicate with.

Intelligence cannot come before life. The best way to develop computer intelligence (assuming it's possible at all), is most likely to start at the bottom, and model lifeforms after what we know about biology. Go ahead and create a "virtual organism" that has a heart, lungs, body, arms, legs, DNA, interacting chemicals, and a brain. Not in the literal sense, of course, but you'd probably want your organism to be able to move around in and interact with a virtual environment, containing the equivalent of

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food, toys, and even enemies to deal with. Just like the real world.

There is a company that is doing this right now, called CyberLife, based in Cambridge, England. I believe that they've been around since about 1993. Their first attempt to do the things that I've described above is in a home-computer game called "Creatures." It's a bit of a "cute" game. The virtual life forms are graphically displayed as cute fuzzy animals (understandable, since they are a company and if they made them appear as squares or triangles it wouldn't sell very well; the game-players range from young kids all the way to biochemists, and there are many levels at which the game can be enjoyed). Some people will likely blow it off as being "just a game" or as a "Tamogotchi," but this is actually the most cutting-edge artificial life technology around. They've also begun research on creating a virtual life form that can autonomously fly an airplane (with no human guidance whatsoever; no remote control). According to a couple of articles I've read, the results are pretty amazing.

CyberLife's goal is to create artificial human-like intelligence by the year 2020. It seems that if they continue in the direction they've headed in, they'll almost certainly do this sometime in the next century. Assuming it's possible at all, of course—but after all that I've read and seen about this stuff, I don't really see why it shouldn't be.

Here are some websites to visit for more info/better explanation than I can give:

http://www.creatures-lab.com/ (Click on "The Science.")

http://www.newscientist.com/ns/980509/features.html

http://www.cyberlife.co.uk/ (Click on "Archives.")

MICHAEL DAVISSON
ST.ANN, MO■

(Biolog continued from p. 43)

instructor was Ted Sturgeon's daughter Tandy. When she ascertained he was having trouble keeping a major and was working on stories all the time, she told him he was a writer—whether he liked it or not. Unfortunately, ISU, like most universities, does not offer a major in writing. Through seven years of university education he had kept trying to be something else. The prospect of starving in the poorhouse while hacking away at an old computer was frightening. Aspiring writers should note that even someone as talented and well-educated as Wolf submitted stories to *Analog* for eight years before selling one. Getting to know David Nordley and catching his enthusiasm lifted Wolf over the hump.

As for art, Wolf traces his early and continuing inspiration to his father Tonino Read-Rojas, a graphic designer and fine artist. An art teacher at ISU helped to free Wolf from his preconceived notions about art. He learned to ask himself exactly what he was trying to accomplish when writing a story or drawing a picture. Sometimes he feels like switching from one to the other to get his point across better. Wolf thinks he would have developed more quickly as a writer if he hadn't had to share time with art . . . or as an artist without writing. Or faster at both if other interests such as music didn't chew up twenty percent of his time. A cover takes as much energy as a short story, and three covers equal a novella.

When writing, Wolf sketches out scenes that help him visualize the story. When drawing, he thinks about how he would write the scene. His stories are signed Wolf Read. Illustrations are credited to the other guy sharing the same space, Wolf A. Read.■

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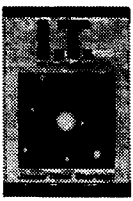

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UPCOMING EVENTS Anthony Lewis

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WISCON 23 (Feminist-oriented SF conference) at Concourse Hotel, Madison, WI. Guests of Honor—Mary Doria Russell, Terri Windling. Registration—$40 until 1 May 1999, $50 at the door. Info—wisCon c/o SF3, Box 1624, Madison, WI 53701. Phone—608.233.8850. Email—wiscon.concom@lists.best.com ; URL—http://www.sf3.org/wiscon/

18–20 June 1999
TRANQUILLITY BASE 1999 (Cincinnati-area science fiction and comic expo) at the Albert B. Sabin Convention Center in downtown Cincinnati, OH. Guests incide Mira Furlan and Robin Curtis. Registration—advance $35 adults, $25 children under 12; at the door $40 adults, $35 children under 12. Info—Tranquillity Base 1999, 8216 Princeton-Glendale Road #303, West Chester, OH 45069-1675 (include S.A.S.E.). Email—TranBaseOH@aol.com; URL—http://www.skypacer.com/tranbase

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24–27 June 1999
MIDWESTCON 50 (the original SF relaxacon). For details, see http://www.cfg.org/midwestcon/

25–27 June 1999
DARKCON (Arizona sf conference) at Chandler, AZ. Guests of Honor—George Clayton Johnson and William F. Nolan. Registration—$30 until 1 April, $35 at the door. Info—DarkCon, PO Box 5833, Glendale, AZ 85312. Phone—602.978.9314. URL—http://www.darkones.org/

2–6 September 1999
AUSSIECON THREE (57th World Science Fiction Convention) at World Congress Centre, Melbourne, Australia. Guests of Honour—George Turner (in memoriam), Gregory Benford, Bruce Gillespie. Registration—$170 (A$250); supporting $35 (A$45) until 31 January 1999. [These are the latest posted rates and reflect the change in the Australia dollar as of the time this column went to press.] This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition—the works. Info—Aussiecon Three, GPO Box 1212K, Melbourne VIC 3001, Australia. US Agent—PO Box 266, Prospect Heights, IL 60070-0266. URL—http://www.aussiecon3.worldcon.org

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4–7 November 1999
WORLD FANTASY CONVENTION/VOYAGES at Rhode Island Convention Center, Westin Hotel, Biltmore Hotel, Providence, RI. Guests of Honor—Patricia A. McKillip, Charles de Lint, Robert Silverberg, Leo & Diane Dillon; Special Guest—Samuel R. Delany; TM—John M. Ford. Registration—$100 until 31 May 1999, then $125 thereafter (limited to 850); $35 supporting (payable to MCFI). Info—World Fantasy Convention, c/o MCFI, Box 1010, Framingham, MA 01701-1010. fax—617.776.3243 email—wfc@mcfi.org; URL—http://www.mcfi.org/wfc ■

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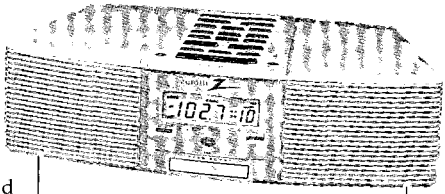
TECHNOLOGY UPDATE

Big sound from a stereo radio—without the big price!

Zenith Audio, a leading electronics manufacturer designs a "Small Footprint," "Big Sound" stereo system and drives the price below $100.



Zenith Audio has developed a Digital Stereo Clock Radio that boasts the acoustic quality and practical features of stereo radios four times as expensive. You'll be amazed at the sound quality and powerful bass you get from a radio this small and this affordable. This stereo radio features an 11-key handheld remote control and an input jack for CD players or other audio sources.

Micro-Electronic Sound Breakthrough

State of the art stereo sound quality in a stylish cabinet

- **AM/FM/TV Bands**
- **Stereo Speakers with Crystal Sound System**
- **Digital Weather Band**
- **37 Preset Station Memories**
- **Ascending Tone Alarm**
- **Wake/Sleep to Radio, Weather or TV Band**
- **"Fail-safe" Alarm System**

Loaded with features. The AM/FM radio features digital tuning for pinpoint reception and crystal-clear sound. The STEREO indicator allows you to tune in to the stereo signal. It also picks up TV and WEATHER signals with 13 TV channels and 7 Weather channels, so your Zenith Audio Clock Radio is a great source of news, entertainment and information. You can program the unit's memory for 37 preset stations, and the tuning buttons can operate either manually or in a automatic search mode.

Practical functions. The backlit clock has several alarm functions, so you can wake to either radio, TV, weather or a buzzer. The sleep timer allows you to fall asleep to up to 90 minutes of music, TV or weather and then shuts off automatically. In the morning, if you need a few extra minutes of sleep, press the SNOOZE bar on the control panel or on the remote. The radio or alarm tone stops for 10 minutes and then sounds again. The unit's battery backup system will maintain the time, alarm and preset station memories in the event of a temporary power interruption.

Factory direct risk-free offer. You can spend hundreds of dollars more on a stereo radio, but why do it? We get the Stereo Clock Radio direct from Zenith and pass the savings on to you. This product comes with a one-year manufacturer's limited warranty and Comtrad's exclusive risk-free home trial. If you are not satisfied for any reason, simply return it within 90 days for a full "No Questions Asked" refund.

Zenith Crystal Clear Stereo. .$99.95 $12 S&H
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Please mention promotional code **4242-15568.**

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TECHNOLOGY UPDATE

Finally—a "cure" for bad breath!

For years, the cause of chronic bad breath has been misdiagnosed, but a dentist's research has led to TheraBreath™, a dramatic treatment system that works naturally and effectively.

It is estimated that over 80 million people worldwide suffer from bad breath, or halitosis. In the past, treatment has consisted of masking the odor with mouthwashes or mints, flooding the mouth with alcohol-based rinses, or the latest craze, popping pills that claim to cure the problem in the stomach. None of these treatments work, because halitosis is caused by bacteria on the back of the tongue and upper throat that produce sulfurous gases. The way to stop bad breath is to stop this process, and this is the secret behind the revolutionary TheraBreath™ system.

A scientific solution. As a dentist with a degree in bacteriology, Dr. Harold Katz has been keenly aware of the widespread nature of this problem. It was not until his daughter came to him about her halitosis, however, that he began to research the problem in earnest. His studies led him to an amazing discovery about the source of bad breath: it does not originate in the digestive system, and the food you eat has no direct effect on your breath.

Dear Dr. Katz,

Our son has had a breath problem for years. He tried mouthwashes and mints. We took him to doctors and dentists, and even had his tonsils removed. Nothing worked, until he tried your product. I am so thankful and thrilled that you found the solution to his problem. You'll never know how much you changed his life!

—M.C., Los Angeles

Certain foods, however, contribute to the production of sulfurous gases in the back of the mouth. Mints and mouthwashes intended to mask or prevent bad breath actually worsen the condition because sugar and alcohol dry out the mouth. Many common medications for everything from high blood pressure to depression have the same drying effect, resulting in the formation of odorous gases. Mucous from post-nasal drip contains dense proteins that are full of sulfur. Some treatments for halitosis contain Sodium Lauryl Sulfate, which can cause canker sores. The only effective means of eliminating the sulfur gas production is to introduce oxygen to the bacteria, causing them to produce tasteless, odorless sulfates.

Effective, safe and natural. At his California Breath Clinic, Dr. Katz has perfected a five-step program for treating halitosis. By using these products on a regular basis, chronic halitosis sufferers can end their problem. The TheraBreath system eliminates the problem of bitter or sour taste in the mouth, improves general periodontal health and will even whiten teeth. TheraBreath has a mild spearmint flavor that tastes great and creates pleasant, neutral breath. It contains no SLS compounds, so you will not suffer from an increase in canker sores or any other side effects. These products are all-natural and simply introduce a greater amount of oxygen into the mouth's chemistry.

Try it risk-free. Try the TheraBreath System for yourself with our risk-free home trial. If you are not fully satisfied, just return it within 30 days for a full refund.

TheraBreath™ . . . . . **$39.95** $6 S&H

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